

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์



ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
1.	Stack Air	Acetaldehyde	Personal Air Sampler/Gilian	S/N 20160605020	25/07/2023	August 2023
			Gas Chromatograph/GC7890B	S/N CN16343040	26/09/2022	September 2023
		Ethanol	Personal Air Sampler/Gilian	S/N 20151002110	25/07/2023	August 2023
			Gas Chromatograph/GC 7890	S/N CN10723012	27/06/2023	June 2024
		Acetone	Mass Spectrometry/MS 5975	US 71236314	27/06/2023	June 2024
			Personal Air Sampler/Gilian	S/N 20151002110	25/07/2023	August 2023
2.	Ambient Air	TSP	Gas Chromatograph/GC 7890	S/N CN10723012	27/06/2023	June 2024
			Mass Spectrometry/MS 5975	US 71236314	27/06/2023	June 2024
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	September 2023
			High Volume Air Sampler/TET	S/N TSP-No.3	04/07/2023	July 2024
			High Volume Air Sampler/TET	S/N TSP-No.14	04/07/2023	July 2024
			High Volume Air Sampler/TET	S/N TSP-No.15	04/07/2023	July 2024
		PM-10	High Volume Air Sampler/TET	S/N TSP-No.24	05/07/2023	July 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	September 2023
			High Volume Air Sampler/TET	S/N PM10-No.3	04/07/2023	July 2024
			High Volume Air Sampler/TET	S/N PM10-No.18	05/07/2023	July 2024
			High Volume Air Sampler/TET	S/N PM10-No.31	13/07/2023	July 2024
		H ₂ S	High Volume Air Sampler/TET	S/N PM10-No.12	04/07/2023	July 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			Certificate of Analysis : Linde	S/N D878365	17/05/2022	May 2024
			H ₂ S Analyzer/API 101A	S/N 341	05/05/2023	November 2023
			H ₂ S Analyzer/Teledyne 100A	S/N 1802	05/05/2023	November 2023
		WS & WD	Wind speed and wind direction/Weather Wizard III	S/N WC41019A77	21/06/2023	June 2024
			Wind speed and wind direction/Weather Wizard III	S/N WC40105A43	21/06/2023	June 2024
			Wind speed and wind direction/Weather Wizard III	S/N WC41020A38	12/09/2022	September 2023
		VOCs	Gas Chromatograph/GC 7890	S/N CN10723012	27/06/2023	June 2024
			Mass Spectrometry/MS 5975	US 71236314	27/06/2023	June 2024

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TET

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บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
3.	Water	Temperature	pH Meter (Temperature)/Horiba F-71G	S/N V3B1F8H3	31/10/2023	October 2024
		pH	pH Meter/Horiba F-71G	S/N V3B1F8H3	31/10/2023	October 2024
		TDS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		DO	DO Meter/HORIBA	S/N D75J0012	14/01/2023	January 2024
		BOD	BOD Incubator	ID/N TET.LAB.BOD 05	11/04/2023	April 2024
		NO ₃ -N	Spectrophotometer/PerkinElmer	S/N 365K9042909	18/08/2023	August 2024
		Pb, Cd	Atomic Absorption Spectrophotometer	S/N 60055070101	12/07/2023	January 2024
		Hg, As	Model/AAAnalyst 600 (Graphite)	S/N 04050110503	29/09/2023	March 2024
			Model/AAAnalyst 100			
		Ni, Mn, Cr	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024
		Na, Al, Ca	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024
		Mg, Cu, Fe	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024
		SS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		Nitrate	Spectrophotometer/PerkinElmer	S/N 365K9042909	18/08/2023	August 2024
		Sulphate	Spectrophotometer/PerkinElmer	S/N 365K9042909	18/08/2023	August 2024
		Fecal Coliform Bacteria	Incubator Model INE 500	S/N E.505.1143	10/04/2023	April 2024
		Coliform Bacteria	Incubator Model INE 500	S/N E.505.0595	10/04/2023	April 2024
		Electrical Conductivity (EC)	Conductivity Meter/Horiba	S/N S205087	10/04/2023	April 2024
		Total Nitrogen	Spectrophotometer/PerkinElmer	S/N 365K9042909	18/08/2023	August 2024
		Phosphorus	Spectrophotometer/PerkinElmer	S/N 365K9042909	18/08/2023	August 2024
		Potassium	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024

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ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
4.	Soil	pH	pH Meter/Horiba F-71G	S/N V3B1F8H3	01/11/2022	November 2023
		Moisture	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		Nitrate-Nitrogen	Ion Chromatograph/ICS-1100	S/N 10010987	29/09/2023	March 2024
		Phosphorus	Spectrophotometer/PerkinElmer	S/N 365K9042909	18/08/2023	August 2024
		Total Cyanide	Spectrophotometer/PerkinElmer	S/N 365K9042909	18/08/2023	August 2024
		Total Mercury	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 04050110503	30/03/2023	September 2023
		Total Arsenic	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 04050110503	30/03/2023	September 2023
		Potassium	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Sodium	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Aluminium	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Total Manganese	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Total Cadmium	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Total Chromium	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Total Copper	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Magnesium	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Total Lead	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
5.	Sound Level & เสียงรบกวน	Leq 24 hr	Sound Level Meter/ST-11D	S/N 820390	15/12/2022	December 2023
			Sound Level Meter/ST-11D	S/N 820391	15/12/2022	December 2023
			Sound Level Meter/ST-11D	S/N 820392	15/12/2022	December 2023
			Sound Level Meter/ST-11D	S/N 820393	15/12/2022	December 2023
			Sound Level Meter/ST-11D	S/N 820394	15/12/2022	December 2023
			Sound Level Meter/ST-11D	S/N 820877	01/02/2023	January 2024
			Sound Level Meter/ST-11D	S/N 820878	01/02/2023	January 2024
			Sound Level Meter/ST-11D	S/N 820879	01/02/2023	January 2024
			Sound Level Meter/CR171-B	S/N G078141	13/03/2023	March 2024
			Sound Level Meter/CR171-B	S/N G078054	09/02/2023	February 2024

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Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
6.	Working Air	Ethanol	Personal Air Sampler/Gillian	S/N 20140605013	27/07/2023	August 2023
			Personal Air Sampler/Gillian	S/N 20140504112	27/07/2023	August 2023
			Gas Chromatograph/GC7890B	S/N CN16343040	26/09/2022	September 2023
		CO ₂	Personal Air Sampler/Gillian	S/N 20140505072	27/07/2023	August 2023
			CO ₂ Meter/GC-2028	S/N R.044296	29/07/2023	July 2024
		Sodium Hydroxide	Personal Air Sampler/Gillian	S/N 20140505071	27/07/2023	August 2023
		Sulfuric Acid	Personal Air Sampler/Gillian	S/N 20140505105	27/07/2023	August 2023
			Ion Chromatograph/ICS-1100	S/N 10010987	30/03/2023	March 2024
		Hydrogen Sulfide	Personal Air Sampler/Gillian	S/N 20140505023	27/07/2023	August 2023
			Personal Air Sampler/Gillian	S/N 20140505029	27/07/2023	August 2023
7.	Occupational Health and Safety		Spectrophotometer/PerkinElmer	S/N 365K9042909	01/11/2022	November 2023
		Calibrator	Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
		Leq 8 hr	Integrated Sound Level/ACO-TYPE 6226	S/N 100099	24/07/2023	31/08/2023
			Integrated Sound Level/ACO-TYPE 6226	S/N 160203	24/07/2023	31/08/2023
		Noise Dose	Noise Dose Meter/SOUNDTEK ST-130	S/N 220100056	07/03/2023	March 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 220100057	07/03/2023	March 2024
		Heat	Thermal Environment Monitor/JANTYTECH/JT2011-E2A	S/N 3522210140	09-13/03/2023	March 2024
			Thermal Environment Monitor/JANTYTECH/JT2011-E2A	S/N 3522210144	09-13/03/2023	March 2024
		Light Intensity	Digital Lux Meter/DIGICON/LX-50	S/N Q066345	19/06/2023	June 2024

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Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด



Personal Pump Calibration Report

Equipment Type	:	Personal Pump/Parameter
Equipment Range	:	0.5-7.0 U/min
Calibration Range	:	0.5-4.0 U/min
Calibration Type	:	Drycal
Calibration S/N	:	DC-L347

[illegible]Calibration Date 25 / 07 / 66

Calibration By 4079

Remark : Uncertainty Type A = $\sigma = \frac{SD}{\sqrt{n}}$

:	SD	=	Standard deviation
:	\bar{X}	=	Mean
			\sqrt{n}



Personal Pump Calibration Report

<i>Equipment Type</i>	:	Personal Pump/Parameter
<i>Equipment Range</i>	:	0.1-7.0 l/min
<i>Calibration Range</i>	:	0.1-4.0 l/min
<i>Calibration Type</i>	:	Drycal
<i>Calibration S/N</i>	:	DC-L347

[illegible]Calibration Date 27 / 07 / 66

Calibration By ABG

Remark : Uncertainty Type A = $\sigma' = \frac{SD}{\sqrt{n}}$

:	SD	=	Standard deviation	\sqrt{n}
:	\bar{X}	=	Mean	

Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph

Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- **Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- **7890B Manuals** are also available on Agilent.com:
 - **Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - **Installation and First Startup** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - **Operation Manual** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf
 - **Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- **Ask the customer to sign the Service Completion section including the customer's and your signature.**

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

System Information

- ☐ Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID Ins-LAB-010 / CN16343040

Instrument System Site and Location Thai Environmental Technic Ltd / Lab

List System Component Product Numbers List the Serial Numbers of each Component

1. G3440B CN16343040

2. G4513A CN16350082

3. G4514A CN16400014

4.

5.

6.

7.

8.

9.

10.

Preparation

- ☐ Discuss any specific issues with the customer before starting.
- ☐ Review the instrument logbook for recorded problems and comments.
- ☐ Save instrument control settings before starting the procedure.
- ☐ Perform a general inspection of the system for cleanliness.
- ☐ Check for proper installation of parts, assemblies, sensors etc.
- ☐ Check system for required installation of components, settings as defined by current Service Notes.
- ☐ Check for required firmware updates and verify with customers if they would like them installed.
- ☐ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

- ☐ Unplug power cord from the power source.
- ☐ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☐ Inspect internal connectors for proper contact and placement.
- ☐ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☐ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☐ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☐ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☐ For the inlets installed, perform inlet maintenance as defined in the 7890 manual – "Maintaining Your GC" - for the inlet(s) installed.
- ☐ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (Vi).
- ☐ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☐ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- ☐ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☐ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual".
If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☐ Record if test passed or failed in the results table.

ALS Maintenance

- ☐ **Section NOT applicable**
- ☐ Check all cabling and configuration settings between GC, tray, and injectors.
- ☐ Vacuum or remove any dust, especially around fans.
- ☐ Check operation of all fans.
- ☐ Check syringes for smooth plunger operation.
- ☐ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☐ Restore the normal operating conditions or customer method using the Data System.
- ☐ Purge the system with carrier flow for 15 minutes
- ☐ Bake out the system, then restore the normal operating conditions
- ☐ After equilibration, check and record the post PM detector signal output values.
Results should be similar or lower than the detector outputs recorded prior to PM.
- ☐ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page

Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector/Signal Outputs	Before PM Service	After PM Service
Front detector output	N/A	17.0/FID
Back detector output	N/A	1101/ μ ECD (unused)
AUX detector output	N/A	99.3/TCD (unused)
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	N/A
PP Inlet PM kit	5188-6498	7890A/B	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & V)	5188-6495	7890A/B	N/A
MMI Cleaning Kit	G3510-60820	7890A/B	N/A
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	N/A
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	N/A
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	N/A
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	N/A
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	N/A

Service Engineer Comments

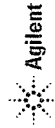
If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

Service Completion

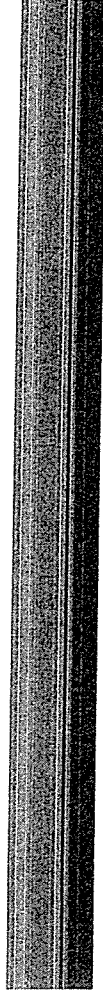
Service request number 6242270600 Date service completed 25 Sep 2023

Agilent signature Saenguthai Tansak Customer signature KO HAT

Total number of pages in this document 9 pages



Agilent CrossLab Start Up Services
Agilent GCMS
Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Introduction

Select the appropriate PM to be done and then perform the checklist under that section

- ☐ Interim Preventive Maintenance
☒ Major Preventive Maintenance

6 months
Yearly

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TQ	7010 Series MS/MS
QT0F	7200 Series QT0F
QT0F	7250 Series QT0F

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-center>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at <http://www.agilent.com/search/support>
- Get answers, Share insights, Build connections:
Join the Agilent Community at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. **Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.**

System Information

- ☒ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID Inst XL MSD VS71236314
Instrument System Site and Location Tru-Bannat Technic Ltd GCMS room

List System Component Product Numbers

1. G3172A List the Serial Numbers of each Component
2. VS71236314

3.	
4.	
5.	
6.	
7.	
8.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
☒ Review the instrument logbook for recorded problems and comments.
☒ Save instrument control settings before starting the procedure.
☒ Perform a general inspection of the system for cleanliness.
☒ Check for proper installation of parts, assemblies, sensors etc.
☒ Check system for required installation of components and settings as defined by current Service Notes
☒ Check for firmware updates and verify with customers if they would like them installed.
Firmware update(s) are strongly recommended.

Customer Responsibilities

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.

Important notice for customers

The customer should complete the following before the Support Provider arrives on site:

- ☒ Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

Note: it is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the vent cycle so that the instrument will be ready for the service representative.

Definition of the Task/Recommended Items within the document

Task	Yes	No	Interim / Major / As needed	Recommended
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Interim <input type="checkbox"/> Major <input type="checkbox"/> As needed <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Interim <input type="checkbox"/> Major <input type="checkbox"/> As needed <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes <input type="checkbox"/> No <input type="checkbox"/> Interim <input checked="" type="checkbox"/> Major <input type="checkbox"/> As needed <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Yes <input type="checkbox"/> No <input type="checkbox"/> Interim <input type="checkbox"/> Major <input checked="" type="checkbox"/> As needed <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Yes <input type="checkbox"/> No <input type="checkbox"/> Interim <input type="checkbox"/> Major <input type="checkbox"/> As needed <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Yes selected means that the task was done or the part was required.
No selected means that the task was not done or the part was not required.
Interim selected means that this task is recommended to be done at 6-month intervals.
Major selected means that this task is recommended to be done yearly, if the customer would like a service to be done at the 6-month interval then the service could be purchased.
As needed selected means that the task was done or the part was used as needed. For example, there could be two types of filters that could be used and this was the one selected.

Preventive Maintenance Procedures

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Review the most recent autotune report. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution.

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record instrument model no. <u>G3172A</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record instrument serial no. <u>VS71236314</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Rough Vacuum <u>1/4</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Record Manifold Vacuum <u>N/A</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Type of Column installed <u>225m by column. PR 172A - 12M.</u>

Capillary

System Checks	Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Verify the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Visually inspect calibrant levels - F-TBA F-H2TD (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Clean air intake(s). Cosmetic cover(s) may need to be removed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

Yes/No	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wet Mechanical vacuum pumps
Yes/No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Description
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Drain and replace mechanical pump oil.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Replace Oil Mist Filter if applicable.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do not use mist filters with Chemical Inhibition.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.
Yes/No	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Dry Mechanical vacuum pumps - Diaphragm
Yes/No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Description
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check for evidence of poor vacuum - Turbo power demand, poor manifold vacuum, etc.
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clear air flow paths of dust.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check that side plate holds closed.

YES/NO	✓	□	□	Dry Mechanical vacuum pumps - Scroll
				Replace the lips seal on the IDP pump.
				Check for evidence of Floor vacuum - Turbo power demand, poor manifold vacuum, etc.
				Replace the Exhaust Filter if required.
				Discuss with customer the need for more frequent changes, if needed.
				Inform customer that pump gas ballast should be installed all the time.
				Perform anti-suckback valve test. Power on until side plate is held closed. power off and check that side plate holds closed.

Cleaning System and Filters	Yes/No	Interim/Major	Description
Fans			
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Remove dust from fans and vent covers.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify fans are functional and that there is enough space around the instrument for proper cooling.
Source cleaning			
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Open analyzer and remove the source.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Disassemble, Clean, Re-assemble source.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Re-install source and close analyzer.
Filters			
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RM5H-2 Helium gas filter – if applicable.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RM5N-2 Nitrogen gas filter – if applicable.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace RM5HY-2 Hydrogen gas filter – if applicable.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GP17988 – Gas Clean Carrier Gas Kit for 7890 for Nitrogen or Helium; Bracket, Mount, and Filter – if applicable.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GP17974 – Gas Clean Filter Kit GC/MS 178; Mount and Filter – if applicable.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GP17973 – Gas Clean Filter; Replacement Filter – if applicable.
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5190-90071 – Methane Gas Filter – if applicable.

Guidance: If gas filter is replaced, write the change date on the filter using a permanent marker.

Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook. Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comment box. Systems in a compliant environment may need additional documentation.

Autism Test Results Table

[illegible]

Agilent Consumed Parts List Table

☒ Section not applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed

Signature Page

Service Engineer Comments (optional)

Comments: The instrument was found to be in good working order. The maintenance was performed as scheduled. The instrument is ready for use.

Service Completion

Service request number 600798458

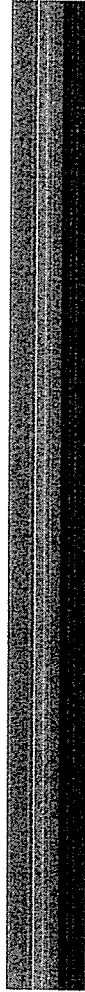
Date service completed 27 June 2023

Agilent signature [Signature]

Customer signature Tewa Pang Onyavattana

Total number of pages in this document 9 pages

Agilent CrossLab Start Up Services Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- **Videos** about specific preparation requirements for your instrument can be found by searching the *Agilent YouTube* channel at <https://www.youtube.com/user/agilent>.
- **7890B Manuals** are also available on **Agilent.com**:
 - **Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - **Installation and First Startup** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - **Operation Manual** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf
 - **Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/63430-90052%207890B_Maintaining%20Guide.pdf

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the **Service Completion** section including the customer's and your signature.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

System Information

- ☒ Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID	GCMS	CN10722012
Instrument System Site and Location	Thai Environmental Service Ltd	GCMS form

List System Component Product Numbers

List the Serial Numbers of each Component

1.	GC440A	CN107223012
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is timed OFF or in a service mode, rearrange the detector output before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and FID cooling fans
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual – "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☐ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☐ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and cask assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

ALS Maintenance

☒ Section NOT applicable

- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☐ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page

Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	N/A	N/A
Back detector output	N/A	N/A
AUX detector output	N/A	N/A
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	Pass

7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	N/A
PP Inlet PM kit	5188-6498	7890A/B	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	N/A
MMI Cleaning Kit	G3510-60820	7890A/B	N/A
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	N/A
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	N/A
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	N/A
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	N/A
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	N/A
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	N/A
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	N/A
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	N/A
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	N/A

Service Engineer Comments

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

Service Completion

Service request number 6059481458 Date service completed 27 June 2023

Agilent signature [Signature] Customer signature [Signature]

Total number of pages in this document 9 of 9



Certificate of Calibration

RECALIBRATION
DUE DATE:
September 21, 2023

Calibration Certification Information
Cal. Date: September 21, 2022 Ta: 296 K
Operator: Jim Tisch Rootmeter S/N: 438320
Calibration Model #: TE-5025A Pat: 748.3 mm Hg
Calibrator S/N: 0068

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3760	3.2	2.00
2	3	4	1	0.9710	6.4	4.00
3	5	6	1	0.8730	8.0	5.00
4	7	8	1	0.8300	8.8	5.50
5	9	10	1	0.8870	12.7	8.00

Data Tabulation			
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)}$ (y-axis)	Qa (x-axis)
0.9870	0.7173	1.4080	0.9957
0.9828	1.0121	1.9917	0.9914
0.9806	1.1233	2.2262	0.9893
0.9796	1.1802	2.3349	0.9882
0.9744	1.4184	2.8160	0.9830
QSTD	m= 2.01042 b= -0.03659 r= 0.99996	QA	m= 1.25889 b= -0.07312 r= 0.99996

Calculations	
Vstd = $\Delta \text{Vol} / ((P_a - \Delta P) / P_{std}) (T_{std} / T_a)$	Va = $\Delta \text{Vol} ((P_a - \Delta P) / P_a)$
Qstd = $V_{std} / \Delta \text{Time}$	Qa = $V_a / \Delta \text{Time}$
For subsequent flow rate calculations:	
Qstd = $1/m \left(\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)} - b \right)$	Qa = $1/m \left(\sqrt{\Delta H \left(\frac{P_a}{P_a} \right)} - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pz:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : TSP
Site ID : Bangkok
Serial No : (No.3)
Date : 4-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 750.6
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp (°C) : 29.2
Average Temp (Deg K) :

Calibration Office

Make : Tisch
Model : TE-5025A
Serial# : 0068
Qstd Slope : 2.01042
Qstd Intercept : -0.36590
Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 29.8558 Intercept : 0.1836 Corr. Coeff : 0.9932
1	12.30	1.926	60.0	57.00	
2	10.00	1.755	54.0	52.00	
3	7.60	1.553	50.0	48.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	

Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta)]-b$$
$$IC = [\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m[(I)\text{Sqrt}(298/Tav)(Pav/760)]-b$$

NOTE: Ensure calibration office has been certified within 12 months of use



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : TSP
Site ID : Bangkok
Serial No : (No.14)
Date : 4-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 750.8
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp (°C) : 29.2
Average Temp (Deg K) :

Calibration Office

Make : Tisch
Model : TE-5025A
Serial# : 0068
Qstd Slope : 2.01042
Qstd Intercept : -0.36590
Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 30.0460 Intercept : 0.3164 Corr. Coeff : 0.9881
1	12.50	1.941	60.0	57.00	
2	9.40	1.707	54.0	52.00	
3	7.20	1.517	50.0	48.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	

Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta)]-b$$
$$IC = [\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m[(I)\text{Sqrt}(298/Tav)(Pav/760)]-b$$

NOTE: Ensure calibration office has been certified within 12 months of use



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : TSP
Site ID : Bangkok
Serial No : (No.15)
Date : 4-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 750.6
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp (°C) : 28.4
Average Temp (Deg K) :

Calibration Orifice

Make : Tisch
Model : TE-5025A
Serial# : 0068
Qstd Slope : 2.01042
Qstd Intercept : -0.36590
Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 30.6943 Intercept : -0.5241 Corr. Coeff : 0.9903
1	12.20	1.919	60.0	57.00	
2	9.40	1.707	54.0	52.00	
3	7.20	1.517	50.0	48.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	# of Observations: 5

Calculations

Qstd = $1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta))-b]$
IC = $1/m[(I)(\text{Sqrt}(Pa/Pstd)(Tstd/Ta))]-b]$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:
 $1/m[(I)(\text{Sqrt}(298/Pav)(Pav/760))]-b]$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By : _____

Approve By : _____

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : TSP
Site ID : Bangkok
Serial No : (No.24)
Date : 5-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 750.8
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp (°C) : 28.6
Average Temp (Deg K) :

Calibration Orifice

Make : Tisch
Model : TB-5025A
Serial# : 0068
Qstd Slope : 2.01042
Qstd Intercept : -0.36590
Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 30.2297 Intercept : 0.1413 Corr. Coeff : 0.9875
1	12.50	1.941	60.0	57.00	
2	9.20	1.691	54.0	52.00	
3	7.20	1.517	50.0	48.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	# of Observations: 5

Calculations

Qstd = $1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta))-b]$
IC = $1/m[(I)(\text{Sqrt}(Pa/Pstd)(Tstd/Ta))]-b]$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:
 $1/m[(I)(\text{Sqrt}(298/Pav)(Pav/760))]-b]$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By : _____

Approve By : _____

m = sampler slope
b = sampler intercept
I = chart response
Tav = daily average temperature
Pav = daily average pressure



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : PM10
Site ID : Bangkok
Serial No : (No. 3)
Date : 4-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Average Press. (mm Hg) : 750.8
Average Temp (°C) : 28.2
Corrected Pressure (mm Hg) : 760.0
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp: (Deg K) :

Calibration Onifice

Make : Tishch
Model : TB-5025A
Serial#: 0068
Qstd Slope : 2.01042
Qstd Intercept : -0.03659
Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 34.3523 Intercept : 0.5343 Corr. Coeff : 0.9868
1	12.50	1.777	60.0	60.00	
2	9.50	1.551	54.0	54.00	
3	7.20	1.353	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.20	0.898	30.0	30.00	

Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta)]-b$$
$$IC = [1/\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]-b$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope
b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)

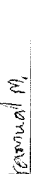
Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:
 $1/m(1) [\text{Sqrt}(298/Tav)(Pav/760)]-b$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By : 

Approve By : 



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : PM10
Site ID : Bangkok
Serial No : (No. 18)
Date : 5-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Average Press. (mm Hg) : 750.5
Average Temp (°C) : 28.5
Corrected Pressure (mm Hg) : 760.0
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp: (Deg K) :

Calibration Onifice

Make : Tishch
Model : TB-5025A
Serial#: 0068
Qstd Slope : 2.01042
Qstd Intercept : -0.03659
Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 35.0529 Intercept : 0.4420 Corr. Coeff : 0.9697
1	12.00	1.741	60.0	60.00	
2	9.20	1.527	54.0	54.00	
3	7.00	1.334	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	

Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta)]-b$$
$$IC = [1/\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]-b$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope
b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)


Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:
 $1/m(1) [\text{Sqrt}(298/Tav)(Pav/760)]-b$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By : 

Approve By : 



Thai Environmental Technic Limited
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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 13-Jul-23
ITEM : PM10 Serial No : (No. 31) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 750.8 Corrected Average (mm Hg) :
Average Temp (°C) : 28.7 Average Temp: (Deg K) :

Calibration Orifice

Make : Ttech Qstd Slope : 2.01042
Model : TB-5025A Qstd Intercept : -0.03659
Serial# : 0068 Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 30.3423 Intercept : 4.5728 Corr. Coeff : 0.9299
1	12.20	1.756	60.0	60.00	
2	9.40	1.543	45.0	45.00	
3	7.20	1.353	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta)]-b$$
$$IC = [1/\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:
 $1/m(I)[\text{Sqrt}(298/Tav)(Pav/760)]-b$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By :

Approve By :



Thai Environmental Technic Limited
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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 4-Jul-23
ITEM : PM10 Serial No : (No. 12) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 750.8 Corrected Average (mm Hg) :
Average Temp (°C) : 28.2 Average Temp: (Deg K) :

Calibration Orifice

Make : Ttech Qstd Slope : 2.01042
Model : TB-5025A Qstd Intercept : -0.03659
Serial# : 0068 Calibration Due Date : 21-Sep-23

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 34.6658 Intercept : 0.5977 Corr. Coeff : 0.9237
1	12.20	1.756	60.0	60.00	
2	9.20	1.527	54.0	54.00	
3	7.40	1.371	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O)(Pa/Pstd)(Tstd/Ta)]-b$$
$$IC = [1/\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:
 $1/m(I)[\text{Sqrt}(298/Tav)(Pav/760)]-b$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By :

Approve By :



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

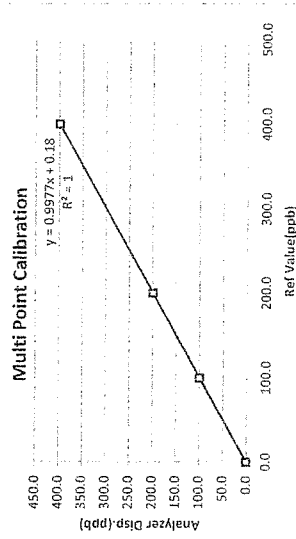
Calibrate Date : 5-May-23
Analyzer Type : H₂S
Brand : API
Model : 101 A
Serial Number : 341 (No. 3)
Range : 500 PPB
Temperature (°C) : 25 °C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : D878365

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	2.4	0.0	0.0
Span	400.0	420.0	400.0	0.00

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp(ppb)	Output Difference	
		Diff(ppb)	Abs Percent Diff
0.0	0.4	0.00	0.10
100.0	99.8	-0.2	0.20
200.0	199.5	-0.5	0.25
400.0	399.4	-0.6	0.15
Average Diff (%)		0.18	



Calibrate by:

ghis

Approved by:

Piyakarn B

แก้ไขครั้งที่: 00

วันที่อนุมัติ: 02/09/15

ภาพเพิ่มเติม: QF-QP16-06

Thai Environmental Technic Limited
1/6 Soi Rangkhambang 145 Kwang/Phet Saphan Sung Bangkok 10240 Thailand
Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7979 • admin@et1995.com • www.et1995.com



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

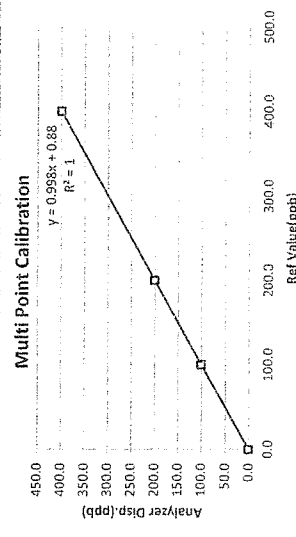
Calibrate Date : 5-May-23
Analyzer Type : H₂S
Brand : Teledyne
Model : 101 B
Serial Number : 1802 (Bo.4)
Range : 500 PPB
Temperature (°C) : 25 °C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : D878365

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	1.8	0.0	0.0
Span	400.0	388.0	400.0	0.00

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp(ppb)	Output Difference	
		Diff(ppb)	Abs Percent Diff
0.0	0.4	0.4	0.00
100.0	101.1	1.1	0.01
200.0	200.8	0.8	0.00
400.0	399.8	-0.2	0.00
Average Diff (%)		0.41	



Calibrate by:

ghis

Approved by:

Piyakarn B

แก้ไขครั้งที่: 00

วันที่อนุมัติ: 02/09/15

ภาพเพิ่มเติม: QF-QP16-06

Thai Environmental Technic Limited
1/6 Soi Rangkhambang 145 Kwang/Phet Saphan Sung Bangkok 10240 Thailand
Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7979 • admin@et1995.com • www.et1995.com

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 21 June, 2023 Certification No. 21723

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III

Serial No. : WC41019A77 ID No. : No.7

Customer : Thai Environmental Technic Limited.

1/6 Soi Ramkhamhaeng 145,

Khwaeng/Khet Saphan Sung, Bangkok 10240.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.3 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 842 S/N 91563

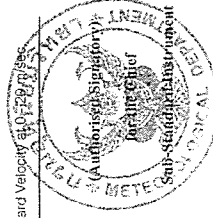
: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90A-H)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION



Calibrated by : **Natthapong** Signed : **Mr. Pisod Pipmasut**

Mr. Watchampol Subwat

Mechanical Engineer

THE LINDE GROUP

Certificate of Analysis Special Gases Mixture

Customer Details
Name: Thai Environmental Technic Limited
Address: 1/6 Soi Ramkhamhaeng 145, Saphan Sung, Khet Saphan Sung, Bangkok 10240
Customer Tag No.:

Certificate Details		Date of Issue:		Expiry date	
Number:	1533/72	17-May-2022		16-May-2024	
Material Details		Material Code:		Cylinder No.	
Production Order:	90171538	Filling pressure:		Valve:	
Gas content:	1.38 M ³ (nominal)	Cylinder Material:		Cylinder Size:	
Cylinder Owner:	LINDE	Spectroscopical		10 L	

Laboratory Report		Method of Analysis ¹	
Component	Analysis Result ²	Uncertainty ²	(1) ACC-5CD-02
Hydrogen Sulphide in Nitrogen	18.0 ppm	± 5% relative	

Recommend usage condition
Minimum utilization: 5% of actual content or before expire date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments

Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%, the measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognized national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Satanya Paanyasoonitorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.
PS-002 (Rev. 1)
Issued: 21-June-2023

Page 1 of 1
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OSSEN AUSA (Siam) Co., Ltd. (มหาชน)

15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 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1192, 1193, 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1216, 1217, 1218, 1219, 1220, 1221, 1222, 1223, 1224, 1225, 1226, 1227, 1228, 1229, 1230, 1231, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, 1263, 1264, 1265, 1266, 1267, 1268, 1269, 1270, 1271, 1272, 1273, 1274, 1275, 1276, 1277, 1278, 1279, 1280, 1281, 1282, 1283, 1284, 1285, 1286, 1287, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1296, 1297, 1298, 1299, 1300, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1324, 1325, 1326, 1327, 1328, 1329, 1330, 1331, 1332, 1333, 1334, 1335, 1336, 1337, 1338, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 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1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1699, 1700, 1701, 1702, 1703, 1704, 1705, 1706, 1707, 1708, 1709, 1710, 1711, 1712, 1713, 1714, 1715, 1716, 1717, 1718, 1719, 1720, 1721, 1722, 1723, 1724, 1725, 1726, 1727, 1728, 1729, 1730, 1731, 1732, 1733, 1734, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1743, 1744, 1745, 1746, 1747, 1748, 1749, 1750, 1751, 1752, 1753, 1754, 1755, 1756, 1757, 1758, 1759, 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1767, 1768, 1769, 1770, 1771, 1772, 1773, 1774, 1775, 1776, 1777, 1778, 1779, 1780, 1781, 1782, 1783, 1784, 1785, 1786, 1787, 178



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 217/23

21 June, 2023

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacuum inches H ₂ O	Velocity m/sec	Correction m/sec
1.00	-	-	0.4	0.60
3.02	-	-	2.3	0.72
5.00	-	-	4.5	0.50
7.00	-	-	6.3	0.70
9.02	-	-	8.5	0.52
11.01	-	-	10.3	0.71
13.01	-	-	12.5	0.51
15.01	-	-	14.3	0.71
17.02	-	-	16.5	0.52
20.02	-	-	19.3	0.72

Wind Aloft Plotting Board.

US DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Mr. Watcharapol Subwat

Mr. Watcharapol Subwat
Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 21 June, 2023

Certification No. 218/23

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III

Serial No. : WC40105A43 ID No. : No.8

Customer : Thai Environmental Technic Limited.

1/5 Soi Ramkhamhaeng 14/5,

Khwaeng/Khet Saphan Sung, Bangkok 10240.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.5 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0850.0000 serial 9023

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 20 m/sec

Calibrated by : Mr. Watcharapol Subwat
Mechanical Engineer

Signed : Mr. Pisit Ponsit





The Result of Calibration

21 June, 2023 Certification No. 218/23
Page : 2 of 2

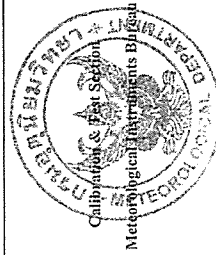
Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacuum inches H ₂ O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.7	0.30
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.7	0.32

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer



Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue : 12 September, 2022 Certification No. 330/22
Page : 1 of 2

Object : Wind speed and wind direction
Manufacturer : Davis Instruments Inc.
Type : Weather Wizard III
Serial No. : WC41020A38 ID No. : No.20
Customer : Thai Environmental Technic Limited,
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung, Bangkok 10240.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.6 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731241480 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90A14)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION



Calibrated by : *Watchapol* Signed :

Mr. Watchapol Subwat Mr. Pised Promsit

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2304, 0-2309-0469

The Result of Calibration

Certification No. 330/22

12 September, 2022

Page : 2 of 2

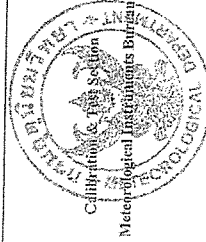
Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure Inches H2O	Vacuum Inches H2O	Velocity m/sec	Correction m/sec
1.00	-	-	0.4	0.60
3.02	-	-	2.7	0.32
5.00	-	-	4.9	0.10
7.00	-	-	6.8	0.20
9.02	-	-	8.5	0.52
11.01	-	-	10.8	0.21
13.01	-	-	12.5	0.51
15.01	-	-	14.8	0.21
17.02	-	-	16.5	0.52
20.02	-	-	19.8	0.22

Wind Aloft Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Wacharapol Subwat

Mr. Wacharapol Subwat
Mechanical Engineer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH0641
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : F-71G
Serial No. : V3B1F8H3
ID No. : Ins-LAB-025
Condition As-Received: Used Item
Received Date : 31 October 2023
Calibration Date : 31 October 2023
Reference : 2310-0843OC-1
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Calibration Place : Laboratory (Thai Environment Technic Limited)
Ambient Temperature : (25.8 - 24.6) °C
Relative Humidity : (69.3 - 65.6) %
Calibration Procedure : In - house method :
- GP-OCH2 by direct measurement with standard
voltage calibrator and direct measurement
with certified reference material (CRM)

Calibrated by : Khit Ruttanaprapachai

Approved by : *Saithip*
Approved Signatory

(✓) Saithip Meangmai
() Warekom Lengagtrakul
() Ponpan Palpim

Issue Date : 10 November 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services

A 0060437



Cert. No.: 23CHO641
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :-
Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 43160066 130RC092 23E1284 10 Apr 2024
2) Digital Thermometer 130RC018 23T1595 13 Sep 2024
This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	931958	01 Oct 2025
pH 6.865	CPA chem	788996	01 Jan 2024
pH 9.181	CPA chem	931960	01 Oct 2024

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage		Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
		mV	Input	mV	pH		
pH Meter S/N.: V3B1F8H3	4.000	177.48		177.5	4.000	0.058	2.00
	6.860	8.28		8.3	6.860	0.058	2.00
	7.000	0.00		0.0	7.000	0.058	2.00
	9.180	-128.97		-128.9	9.180	0.058	2.00
	10.000	-177.48		-177.4	10.000	0.058	2.00

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7,9)

Unit Under Calibration	Standard Buffer Solution	Actual pH Reading		Actual mV Reading		Uncertainty of pH measurement (\pm)	Coverage factor k
		pH	mV	mV	pH		
pH Electrode S/N.: 9X2E0223	4.008	4.031	160.0	160.0	4.0052	2.00	2.00
	6.865	6.870	-7.4	-7.4	0.0087	2.00	2.00
	9.181	9.186	-142.0	-142.0	0.014	2.00	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-o0o-

Signature

a 1188742



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3900-29 FAX. 0-2719-9454



Cert.No.: 23MM180
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : AB204

Serial No. : 1116392227

ID No. : TET.LAB.BAL01

Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240

Location : Balance Room

Received order : 10 April 2023

Calibration Date : 11 April 2023

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : Khit Rutlanaprapachai

Approved by : *Signature*

() Ponthippa Tarneyakul
() Malee Butkruea
() Suwil Imjel

Issue Date : 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053464



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0146OC-12
Page: 2 of 3
Cert.No.: 23MM160

Procedure used :-
Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by External Calibration

Range capacity : 0 g to 210 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
100	99.9982	+0.0018	0.18	2.00
200	199.9965	+0.0035	0.29	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00007
200	0.00007

Nadu

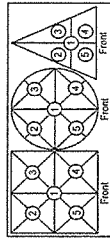
a 1158499



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0146OC-12
Page: 3 of 3
Cert.No.: 23MM160

2. Effect of off center loading
A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0002	-0.0002	-0.0003	-0.0003	-0.0002	0.0001



3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.14	2.11
0.01	0.0100	0.0000	0.14	2.11
0.1	0.1001	-0.0001	0.14	2.11
0.5	0.5000	0.0000	0.14	2.11
1	1.0001	-0.0001	0.14	2.11
5	5.0000	0.0000	0.14	2.11
10	9.9999	+0.0001	0.14	2.11
25	24.9998	+0.0002	0.15	2.07
50	49.9998	+0.0002	0.16	2.05
100	99.9999	+0.0001	0.18	2.00
200	200.0000	0.0000	0.29	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

-o0o-

Nadu

a 1158498



Certificate of Calibration


Certificate Number : SPR23010143-5 Page : 1 of 3
 Customer : Thai Environmental Technic Limited.
 1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
 Sung, Bangkok 10240, Thailand.

Equipment Name : DO Meter
 Manufacturer : Horiba
 Model : OM-71G
 Serial Number : D75J0012
 ID. Number : No.07

Environmental Conditions
 Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ Received Date : 13 Jan 2023
 Relative Humidity : $50\text{ \%} \pm 15\text{ \%}$ Calibration Date : 14 Jan 2023
 Location of Calibration : In-Lab Recommend Due Date : 14 Jan 2024
 Calibration Procedure : In-House Method Date of Issue : 15 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
 All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Kijja Visitsilp Approved by : 
 Calibration Officer (Ms. Bussakorn Chaikaew)
 Authorized Signatory



Calibration Report

Certificate Number : SPR23010143-5 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Zero Oxygen Solution	H17040L	Lot. S0066/21	01B24	31 Jan 2027
Electronic Balance	N/A	14246789	SPR22110015-7	10 Nov 2023
Standard Weight Set	Class E2	B746971965	C02221902	16 Sep 2023

Traceability

This certification is traceable to the International System of Unit maintained at :
 HANNA - Hanna Instruments (Thailand) Ltd.
 SP Metrology - SP Metrology system (Thailand) Co.Ltd.
 SPC - SPC Calibration Center Co.Ltd.



Result of Calibration

Certificate No.: SPR23010143-5 Page : 3 of 3

Function : Dissolved Oxygen Permanance Test

Unit : mg/L

Range	Actual Standard	UUC. Heading	Error	Uncertainty (±)
0-40	0.3	0.22	-0.08	0.13
	8.3	8.19	-0.11	0.13

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%
- End of Certificate -



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-20 FAX. 0-2719-9484



Cert. No.: 23TM673
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Accuplus
Model : i250
Serial No. : 0408-0115-0008
ID No. : TET.LAB.BOD05
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Location : Laboratory (Thai Environmental Technic Limited)
Received Order : 10 April 2023
Calibration Date : 11 April 2023
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Khit Ruttanaprapachai

[Signature]

Approved by : Approved Signatory

() Pornthippa Tameyakul
(☒) Malee Butkruea
() Suwit Imjai

Issue Date : 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-2
Cert. No.: 23TM673
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34972A MY57013711 22LM93 02 Jul 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.

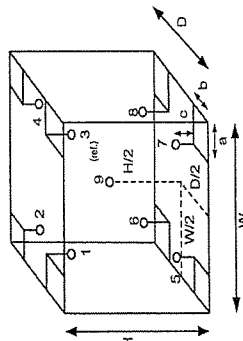
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	
Beginning	Finished
Temp. (°C)	25 26
REL.Humid. (%)	51 54
AC Supply (Volt)	221 221



Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.48 m
b = 10 cm	W = 0.50 m
c = 10 cm	H = 1.1 m
	Capacity = 0.26 m ³

Wdu.

a 1158205



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-2
Cert. No.: 23TM673
Page : 3 of 3

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	19.8	19.7	0.54	0.37	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (± °C)
	1	2	3	4	5	6	7	8	
20.0	20.121	20.227	19.983	20.098	19.992	19.953	19.936	19.914	20.048
									0.72

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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a 1158204



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG HANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9834



Cert. No.: 23CHO493
Page.: 1 of 3

Certificate of Calibration

Equipment : Spectrophotometer

Manufacturer :

Perkin Elmer

Model :

Lambda 365

Serial No. :

365K9042909

ID No. :

-

Condition As-Received:

Used Item

Received Date :

18 August 2023

Calibration Date :

18 August 2023

Reference :

2308-0469OC-1

Submitted by :

Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240

Calibration Place :

Laboratory (Thai Environment Technic Limited)

Ambient Temperature :

(25.5 - 25.3) °C (On-Site)

Relative Humidity :

(57.8 - 60.6) % (On-Site)

Calibration Procedure :

In - house method :
CP-OCH4 based on ASTM E 275-01

Calibrated by :

Kunchit Promprat

Approved by :

Approved Signatory

(✓) Saithip Meangmai
() Warakorn Lengagitrakul
() Ponpan Paipim

Issue Date :

22 August 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert. No.: 23CHO493
Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	8331	105939	28 Sep 2024
2. Wavelength Standard set	8417	100498	25 Mar 2024
3. Wavelength Standard set	8418	100499	25 Mar 2024
4. Stray Light Standard set	8419	108963	01 Feb 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit maintained through :
- Slarna Scientific Ltd.

4. Spectral BandWidth : 1 nm
Scan Speed : 30 nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (± nm)	Coverage Factor k
418.53	418.54	0.12	2.00
536.52	536.13	0.12	2.00
638.00	637.64	0.14	2.05
684.50	684.49	0.13	2.00
879.41	879.42	0.12	2.00

a 1176586

A 0057186



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL.

AAAnalyst 600

Cert. No.: 23CHO493
Page: 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (±Abs)	Coverage Factor k
420.0	Zero 0.5712 0.7510 1.0893	0.0000 0.5699 0.7494 1.0877	0.0028 0.0031 0.0031 0.0033	2.00 2.00 2.00 2.00
546.1	Zero 0.5224 0.6856 0.9937	-0.0001 0.5209 0.6839 0.9921	0.0028 0.0028 0.0028 0.0028	2.00 2.00 2.00 2.00
635.0	Zero 0.5397 0.6832 0.9886	-0.0001 0.5375 0.6810 0.9861	0.0028 0.0028 0.0028 0.0028	2.00 2.00 2.00 2.00

Stray Light

* Straylight at 260.74 nm ± 0.11 nm	Reading at 260.74 nm ± 0.11 nm
Abs	2.0488
%T	0.8951

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.
- Cut-off wavelength of stray light reference material (Potassium Iodide) at wavelength 260.74 nm ± 0.11 nm
- Result = Pass, If Absorbance > 2.00 Abs and Transmission < 1.0 %T at Wavelength 260.74 nm ± 0.11 nm
- * : Not NSC-ONSC Accredited

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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Sandip

a 1176585

Customer : THAI ENVIRONMENTAL
TECHNIC LIMITED.
Address : 1/6 Soi Ramkhamheang 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
User Name: คุณ นวรัตน์ จันทร์เจริญกุล
Phone: 02-3937799
E-mail: keisarin.c@tet1995.com
admin@tet1995.com

Date Tested: 12-n.a.-66
Recommendation Recertification
Period 6 Months
Recertification Due: 12-n.a.-67
Date Last Certified: 20-n.a.-66
Visit Number: 2 OF 2
TH One Source Phone: 081-7316733
E-mail: thonecource@gmail.com

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
AAAnalyst 600	600S5070101	AA WinLab32 Version 6.5
AS 800	801S5070102	
FIAS-100	2288	
TEST STANDARD USED	PART NUMBER	
GFAAS Mixed standard	N9300244	



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 600

SERIAL NUMBER	600S5070101	DATE TESTED	12-01-66
1. INSTRUMENT CHECKS			
A. The Mirror and Lenses Condition			
B. Grating Condition			
C. Replace or Clean Dust Filter			
D. Cleaning the Contact Cylinders			
E. Cleaning the Furnace Windows			
2. AUTOSAMPLE CHECK			
A. Sampling and Arm			
B. Sampling & Rinse Pump			
C. Sample Position & Clean			
D. Clean or Replace the Hall Sensor			
3. COOLING SYSTEM CHECKS			
A. Clean and Change Distill water			
B. Thermosensor			
4. FIAS CHECKS			
A. Pump and 5 Port Valve			
B. Chemifold and Tubing			
C. Power Supply			
D. Flow meter and Gas system			



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 600

SERIAL NUMBER	600S5070101	DATE TESTED	12-01-66
PARAMETER	SPECIFICATION		ACTUAL VAULE
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min		235 mL/min
External Flow	100 ± 10 mL/min		110 mL/min
2. Chromium Baseline Noise (measure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs		0.0015 Int.Abs
	SD ≤ 0.005 Int.Abs		0.0034 Int.Abs
3. Chromium Characteristic Mass(m ₀) and Precision (measure 5 furnace firing using 20 ul sample injections of 10 ug/L Cr standard)			
	m ₀ Results 6.5 pg ± 1.5 pg		6.0 pg
	Precision ≤ 2.0%		0.36 %
4. Copper Characteristic Mass(m ₀) and Zeeman Ratio (measure 5 furnace firing using 20 ul sample injections of 25 ug/L Cu standard)			
	m ₀ Results 17.0 pg ± 3.5 pg		14.2 pg
	Zeeman Ratio 0.58 ± 0.04		0.541



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 600

SERIAL NUMBER 60055070101 DATE TESTED 12-02-66

Remarks :
 Changed The Controller Bd. Atomizer (4 May 2015)

Zeeman Ratio = Atomic Signal (peak area)

Atomic Signal (peak area) - Background Signal (peak area)

This is to certify that the above tests have been performed and the configuration tested

☒ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department TH ONE SOURCE CO., LTD.

(*Krungchai T.*)
 Krungchai Treevichien
 Customer Support Engineer



PerkinElmer™
 instruments.

Certificate of Training

This is to certify that

Krungchai Treevichien

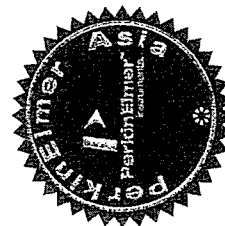
has successfully completed
 Aanalyst 600/700/800 Service Training

09 to 13 February 2004

C.S. Lim

C.S. Lim
 Service Specialist

13 Feb 2004





MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	29-01-66
5. PERFORMANCE TESTS		SPEC.	RESULTS
* A. Neutral density filter checks with Copper (324.8 nm) Neutral Density Filter 0.2 ± 10%		0.180	0.174 Abs.
B. AA Baseline noise test with Copper (324.8 nm) Integration time = 0.5 seconds Replicates = 99 times Standard Deviation		≤ 0.001	0.001
C. Flame sensitivity with Copper (324.8nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner) Stainless steel nebulizer		≥ 0.25	0.275 Abs.
%RSD		≤ 0.3	0.20 %
Measured Characteristic Concentration :			0.080 mg/L

Page 3 of 4



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	29-01-66
Remarks :			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets <input type="checkbox"/> does not meet			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
Service Department TH ONE SOURCE CO., LTD.			
(Krunghchai Treevichien) Customer Support Engineer			

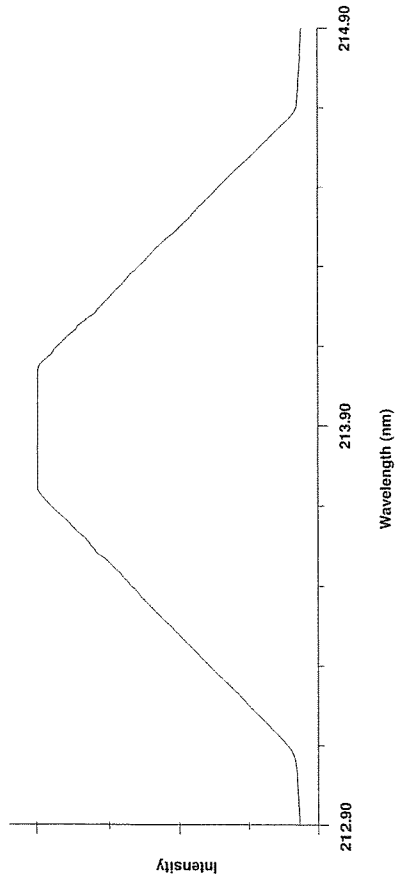
Page 4 of 4

#	mg/L	mg/L	Signal
1	0.000	10:35:46	0.000
2	0.000	10:35:49	0.000
3	0.000	10:35:51	0.000
4	0.000	10:35:53	0.000
5	0.000	10:35:55	0.000
6	-0.001	10:35:57	0.000
7	-0.001	10:36:00	0.000
8	-0.002	10:36:02	0.000
9	-0.001	10:36:04	0.000
10	0.000	10:36:07	0.000
11	-0.001	10:36:09	0.000
12	0.001	10:36:11	0.001
13	0.001	10:36:13	0.001
14	0.001	10:36:15	0.001
15	0.001	10:36:17	0.001
16	0.000	10:36:19	0.000
17	-0.001	10:36:21	0.001
18	0.001	10:36:24	0.000
19	0.000	10:36:26	0.000
20	0.001	10:36:28	0.001
21	0.000	10:36:30	0.000
22	0.002	10:36:32	0.002
23	0.000	10:36:34	0.000
24	0.000	10:36:36	0.000
25	0.002	10:36:38	0.002
26	0.002	10:36:41	0.002
27	0.001	10:36:43	0.001
28	0.001	10:36:45	0.001
29	0.000	10:36:47	0.000
30	-0.001	10:36:49	0.001
31	-0.002	10:36:51	0.000
32	-0.001	10:36:53	0.001
33	-0.001	10:36:55	0.000
34	0.000	10:36:58	0.000
35	0.000	10:37:00	0.000
36	0.000	10:37:03	0.000
37	0.003	10:37:05	0.003
38	0.000	10:37:07	0.000
39	0.000	10:37:09	0.000
40	0.001	10:37:11	0.001
41	-0.001	10:37:13	0.001
42	-0.001	10:37:16	0.001
43	-0.002	10:37:18	0.002
44	-0.001	10:37:20	0.001
45	0.002	10:37:22	0.002
46	0.000	10:37:24	0.000
47	0.001	10:37:26	0.001
48	0.000	10:37:28	0.000
49	0.000	10:37:30	0.000
50	0.001	10:37:33	0.001
51	0.002	10:37:35	0.002
52	0.002	10:37:37	0.002
53	0.001	10:37:39	0.001
54	0.000	10:37:41	0.000
55	-0.001	10:37:43	0.001
56	0.001	10:37:45	0.001
57	0.001	10:37:47	0.001
58	0.000	10:37:50	0.000
59	0.001	10:37:52	0.001

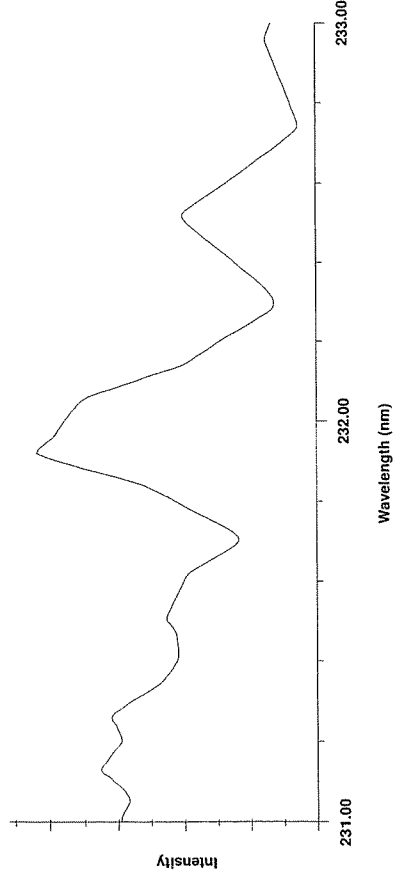
	Mean:	SD :	%RSD:
60	0.001	10:37:54	
61	0.000	10:37:56	
62	0.001	10:37:58	
63	0.000	10:38:00	
64	0.001	10:38:03	
65	0.002	10:38:06	
66	0.002	10:38:08	
67	0.001	10:38:10	
68	0.001	10:38:12	
69	0.002	10:38:14	
70	0.000	10:38:16	
71	0.000	10:38:18	
72	0.000	10:38:21	
73	0.000	10:38:23	
74	0.001	10:38:25	
75	0.001	10:38:27	
76	0.002	10:38:29	
77	0.002	10:38:31	
78	0.000	10:38:33	
79	0.002	10:38:36	
80	0.001	10:38:38	
81	0.000	10:38:40	
82	0.001	10:38:42	
83	0.001	10:38:44	
84	0.001	10:38:46	
85	0.001	10:38:49	
86	0.002	10:38:51	
87	0.002	10:38:53	
88	0.001	10:38:55	
89	0.001	10:38:57	
90	0.000	10:39:00	
91	0.000	10:39:02	
92	0.001	10:39:04	
93	0.000	10:39:07	
94	0.000	10:39:09	
95	0.001	10:39:11	
96	0.001	10:39:13	
97	0.000	10:39:16	
98	0.002	10:39:18	
99	0.001	10:39:20	
Mean:	0.000		
SD :	0.001		
%RSD:	4766.11		

Mean:
SD :
%RSD:

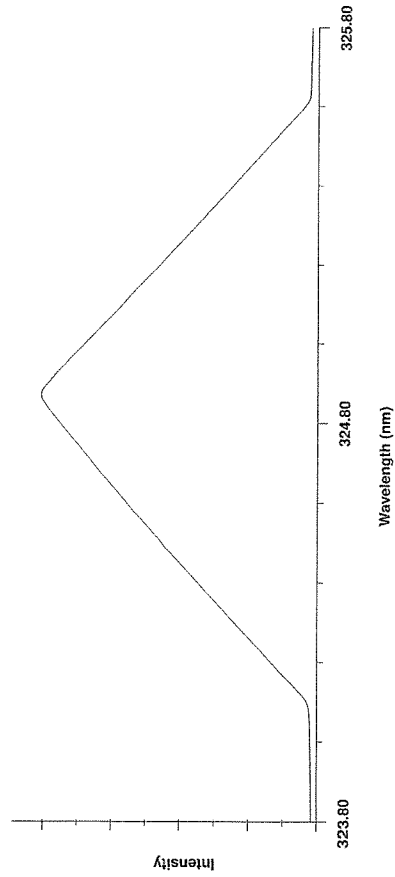
Current Wavelength: 214.90 Peak Wavelength: 213.83



Current Wavelength: 233.00 Peak Wavelength: 231.92



Current Wavelength: 325.80 Peak Wavelength: 324.87



Element: Cu

Method Name: Cu5ppm
Method Description: Cu 5 ppm

Date: 01/01/2002
Technique: Flame
Wavelength: 324.8 nm
Lamp Current: 15
Sample Info File: Untitled
Calibration Equation: Zero Intercept: Nonlinear
Slit Width: 0.70 nm
Energy: 72
Results Data Set:

Element: Cu Seq. No.: 3 AS Loc.: --- Date: 01/01/2002

Sample ID: Calib Blank

Repl	SampleConc	StdConc	BlankCorr	Time
#	mg/L	mg/L	Signal	
1			-0.011	11:30:33
2			-0.011	11:30:46
3			-0.011	11:31:00
4			-0.011	11:31:14
5			-0.011	11:31:28
6			-0.011	11:31:43
7			-0.011	11:31:57
8			-0.012	11:32:11
9			-0.012	11:32:24
10			-0.012	11:32:38
Mean:			-0.011	
SD :			0.000	
%RSD:			3.15	

Auto-zero performed.

Element: Cu Seq. No.: 4 AS Loc.: --- Date: 01/01/2002

Sample ID: Copper 5 ppm

Repl	SampleConc	StdConc	BlankCorr	Time
#	mg/L	mg/L	Signal	
1			0.275	11:33:12
2			0.275	11:33:26
3			0.274	11:33:40
4			0.274	11:33:54
5			0.274	11:34:08
6			0.276	11:34:23
7			0.275	11:34:37
8			0.275	11:34:50
9			0.274	11:35:04
10			0.274	11:35:18
Mean:			0.275	
SD :			0.001	
%RSD:			0.20	

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

Customer : บริษัท เทคนิคัลแวลูไทย
จำกัด
Address : 1/6 ซอยรามคำแหง 145
แขวงสะพานสูง เขตสะพานสูง
กรุงเทพมหานคร 10240
User Name: Khun Natapong
Phone: 02-3737799
Fax:
Date Tested: September 29, 2023
Recommendation Recertification
Period 6 Months
Recertification Due: March 29, 2024
Date Last Certified: April 3, 2023
Visit Number: 2 of 2
PerkinElmer Phone: 02-719-6420 ext 203
PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

MODEL
OPTIMA 8000
S10

TESTED EQUIPMENT

IPV Methods

TEST STANDARD USED

Mixed standard 1/10
Mixed standard 1/100

CUSTOMER SUPPLIED

2 % HNO3
10 % HNO3

**ACCESSORIES/COMPONENT
NOT INCLUDED**

CALIBRATION NUMBER

EXPIRATION

EXPIRATION DATE

November 30, 2023
November 30, 2023

CUSTOMER INITIALS

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078S1310024C
DATE TESTED : September 29, 2023
1. MECHANICAL CHECKS
A. Inspect and clean all fans and filters. ☐ OK
B. Inspect and replace as necessary, all torch components including the RF coil. ☐ OK
C. Inspect all tubing for sign of clacking or leaking. ☐ OK
D. Adjust water and gas pressure regulator settings. ☐ OK
E. Inspect and leak check pneumatics drawers. ☐ OK
F. Clean the exterior of the instrument. ☐ OK
2. OPTICAL CHECKS
A. Inspect and clean all optical components. ☐ OK
B. As required, check and replace all purgefilters. ☐ OK
C. Recheck optical alignment. ☐ OK
3. COOLING SYSTEM CHECKS
A. Perform preventive maintenance on chiller. ☐ OK
B. Flush out the chiller every six months. ☐ OK
4. PERFORMANCE CHECKS
A. Torch View Alignment. ☐ OK
B. Wavelength Calibration. ☐ OK



MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078S1310024C	DATE TESTED : September 29, 2023	
PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV		
As 193.696 nm	≤ 0.009	0.00702
Ni 231.604 nm	≤ 0.011	0.00790
Ni 341.476 nm	≤ 0.015	0.01192
Spectral Resolution : VIS		
Ba 455.403 nm	≤ 0.020	0.01500
Precision		
Zn 206.200 nm	% RSD < 1.0	0.60
Mg 280.271 nm	% RSD < 1.0	0.36
Mg 285.213 nm	% RSD < 1.0	0.67
Ba 455.403 nm	% RSD < 1.0	0.72
Detection Limits : Axial		
As 193.696 nm	3(SD) ppb	1.11
Se 196.026 nm	3(SD) ppb	7.96
Tl 190.801 nm	3(SD) ppb	0.06
Pb 220.353 nm	3(SD) ppb	3.67
Detection Limits : Radial		
As 193.696 nm	3(SD) ppb	0.28
Zn 213.857 nm	3(SD) ppb	0.83
Mn 257.610 nm	3(SD) ppb	0.07
La 379.478 nm	3(SD) ppb	1.89
Ba 455.403 nm	3(SD) ppb	0.08
Ba 493.408 nm	3(SD) ppb	0.12
BEC : Axial (IB X 1000)/(IS-IB)		
Mn 257.610 nm	≤ 30 ppb	15.70
BEC : Radial (IB X 1000)/(IS-IB)		
Mn 257.610 nm	≤ 30 ppb	23.69



MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078S1310024C _____ DATE TESTED : September 29, 2023 _____

Remarks : _____
Commissioning follow as commissioning performance sheets. _____

☒ meets ☐ does not meet

This is to certify that the above tests have been performed and the configuration tested

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department PerkinElmer Ltd.

Authorized Representative : Wiphan Promlumda (Wiphan Promlumda)
Service Engineer

PerkinElmer TruQ
Atomic Spectroscopy Standard



Certificate of Analysis

PerkinElmer Number: N9300221
Description: Instrument Calibration Standard 4
Matrix: 5% HNO₃
Lot Number: 58-169CRY1

Certification Date: MAY -- 2022
Expiration Date: NOV 30 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	100 µg/mL	99.8 µg/mL	3103a*	Pb	50.0 µg/mL	49.9 µg/mL	3128*
Tl	100 µg/mL	99.4 µg/mL	3158*	Se	50.0 µg/mL	49.8 µg/mL	3149*
Cd	50.0 µg/mL	50.0 µg/mL	3108*				

* - indicates NIST SRM
† - indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 57-156CR, 1-177YJ, 54-134CR

Refer to side 2 for details of certification

Balances are calibrated with weight sets traceable to NIST.
We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Parikh

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PerkinElmer, Inc.
U.S.A. Tel: 1-203-925-4600
U.S.A. Toll Free: 1-800-762-4000

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PerkinElmer TruQ
Atomic Spectroscopy Standard



Certificate of Analysis

PerkinElmer Number: N9300221
Description: Instrument Calibration Standard 4
Matrix: 5% HNO₃
Lot Number: 58-169CRY1

Certification Date: MAY -- 2022
Expiration Date: NOV 30 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	100 µg/mL	99.8 µg/mL	3103a*	Pb	50.0 µg/mL	49.9 µg/mL	3128*
Tl	100 µg/mL	99.4 µg/mL	3158*	Se	50.0 µg/mL	49.8 µg/mL	3149*
Cd	50.0 µg/mL	50.0 µg/mL	3108*				

* - indicates NIST SRM
† - indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 57-156CR, 1-177YJ, 54-134CR

Refer to side 2 for details of certification

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We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Parikh

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PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N0691579
 Description: Multi-Element Standard
 Matrix: 2% HNO₃
 Lot Number: 58-146CRX1

Certification Date: APR -- 2022
 Expiration Date: OCT 30 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	49.3 µg/mL	3103a*
K	50.0 µg/mL	50.0 µg/mL	3141a*
La	10.0 µg/mL	9.91 µg/mL	3127a*
Li	10.0 µg/mL	9.96 µg/mL	3128a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*
Ni	10.0 µg/mL	9.89 µg/mL	3136*
Sr	10.0 µg/mL	10.0 µg/mL	3153a*
Zn	10.0 µg/mL	9.99 µg/mL	3168a*
Ba	1.00 µg/mL	0.996 µg/mL	3104a*
Mg	1.00 µg/mL	0.992 µg/mL	3131a*

* - Indicates NIST SRM

† - Indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 57-138CR, 3-250MJ, 57-024CR, 57-208CR

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.
 We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Parikh



PerkinElmer, Inc.
 U.S.A. Tel: 1-203-925-4800
 U.S.A. Toll Free: 1-800-762-4000

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PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N0691579
 Description: Multi-Element Standard
 Matrix: 2% HNO₃
 Lot Number: 58-146CRX1

Certification Date: MAY -- 2022
 Expiration Date: NOV 30 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	49.3 µg/mL	3103a*
K	50.0 µg/mL	50.0 µg/mL	3141a*
La	10.0 µg/mL	9.91 µg/mL	3127a*
Li	10.0 µg/mL	9.96 µg/mL	3128a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*
Ni	10.0 µg/mL	9.89 µg/mL	3136*
Sr	10.0 µg/mL	10.0 µg/mL	3153a*
Zn	10.0 µg/mL	9.99 µg/mL	3168a*
Ba	1.00 µg/mL	0.996 µg/mL	3104a*
Mg	1.00 µg/mL	0.992 µg/mL	3131a*

* - Indicates NIST SRM

† - Indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 57-138CR, 3-250MJ, 57-024CR, 57-208CR

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.
 We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Parikh



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 U.S.A. Tel: 1-203-925-4800
 U.S.A. Toll Free: 1-800-762-4000

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2717-9484



Cert. No.: 23TM605
Page: 1 of 3

Certificate of Calibration

Equipment: Incubator
Manufacturer: Memmert
Model: INE 500
Serial No.: E505.1143
ID No.: TET.LAB.ING.02
Submitted by: Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Location: Laboratory (Thai Environmental Technic Limited)
Received Order: 10 April 2023
Calibration Date: 10 April 2023
Ambient Temperature: $(26 \pm 10) ^\circ\text{C}$
Relative Humidity: $(50 \pm 30) \%$

Calibrated by: Man Pattanapongpalboon

Approved by:
Approved Signatory

() Ponthippa Tameyakul
(x) Malee Bukruea
() Suwit Injai

Issue Date: 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

A 0053458



PerkinElmer

Global Service Training Department
Service Engineer Certification

Wiphan Promlunda

This is to certify that the above mentioned
PerkinElmer representative has been trained to
service the instrument indicated below:

ICP220B Optima S300 & Optima 4X/5X/7X00 Series

Instructor:

Geoff Cook

Date: July 20, 2012

Certified by:

(Manager, Global Training Operations)



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-5
Page : 2 of 3

Procedure Used :-
Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

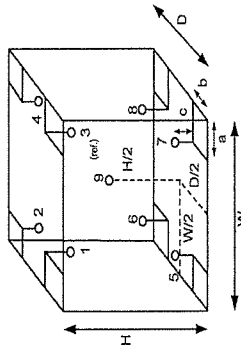
1. Reference standard instrument:-
Instrument Model Serial No. Due Date
1) Data Acquisition 34970A MY41021843 27 Dec 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	54	57
AC Supply (Volt)	223	219



Probe Installation Details :

Dimension of Chamber :	
a =	5.0 cm
b =	5.0 cm
c =	5.0 cm
Capacity =	0.11 m ³

Malu

a 1158195



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-5
Page : 3 of 3

Procedure Used :-
Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-
Instrument Model Serial No. Due Date
1) Data Acquisition 34970A MY41021843 27 Dec 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.988	34.938	34.900	34.866	35.143	35.446	35.083	35.362	34.765	0.30
37.0	36.978	36.975	36.972	36.971	37.390	37.559	37.324	37.437	37.010	0.30
44.5	44.631	44.502	44.429	44.412	44.752	45.106	44.600	45.021	44.183	0.32

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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Malu

a 1158194



TEL. 0-2717-3000-29 FAX. 0-2719-9484

Certificate of Calibration

Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240

Calibrated by :
Man Pattanapongpaiboon

✓) Pornthippa Tameyakul
✓) Malee Butkruea
) Suwit Imjai

Issue Date : 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>
1) Data Acquisition	34970A	MY41021843

2. This certificate is valid only to the item calibrated on date and place of calibration.

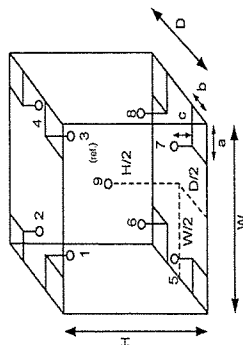
3. This certification is traceable to the International System of Unit.

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
RELHumid. (%)	54	57
AC Supply (Volt)	223	219



Probe Installation Details :

a =	5.0	cm
b =	5.0	cm
c =	5.0	cm

Dimension of Chamber :

D =	0.40	m
W =	0.56	m
H =	0.48	m
Capacity =	0.11	m ³

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

1000

A 0053457

a 1158197



Cert. No.: 23TM604
Page : 3 of 3

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-01480C-4
Result of Calibration : () Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.065	0.32	0.67	2
41.5	41.5	41.5	0.032	0.49	0.63	2
44.5	44.5	44.5	0.086	0.60	0.86	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.870	34.847	34.722	34.860	34.744	35.047	34.842	35.288	35.026	0.30
41.5	41.625	41.612	41.461	41.733	41.300	41.428	41.418	41.874	41.758	0.30
44.5	44.744	44.708	44.553	44.882	44.205	44.476	44.352	44.931	44.778	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation line as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-000-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 22CH0626/1
Page.: 1 of 2

Certificate of Calibration

This Certificate was issued to replace to the Certificate No.22CH626 .

Equipment : pH Meier

Manufacturer : Horiba

Model : F-71G

Serial No. : V3B1F8H3

ID No. : -

Condition As-Received : Used Item

Received Date : 01 November 2022

Calibration Date : 01 November 2022

Reference : 2211-0001OC-8

Submitted by :

Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240

Calibration Place :

Laboratory (Thai Environment Technic Limited)

Ambient Temperature : (24.9 - 26.5) °C

Relative Humidity : (59 - 43) %

Calibration Procedure : In - house method :

- CP-0CH2 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by :

Uthen Kankawi

Approved by :

Warakorn

Approved Signatory

() Malee Butkruea

() Sathip Meangmai

(✓) Warakorn Lemgagrakul

Issue Date :

2 March 2023

The Uncertainties are for a confidence probability of approximately 95 %

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

a 1158196

A 0051492



Cert. No.: 22CHO626/1
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -
- | Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 46530031 | 130RC098 | 22E3313 | 06 Oct 2023 |
| 2) Digital Thermometer | 130RC017 | 22T777 | | 20 Apr 2023 |
- This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.865	CPA chem	788996	01 Jan 2024
pH 9.181	CPA chem	794123	14 Feb 2023

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
		pH	mV	mV	pH		
pH Meter S/N.: V3B1F8H3	4.000		177.48	177.5	4.000	0.058	2.00
	6.860		8.28	8.3	6.860	0.058	2.00
	7.000		0.00	0.0	7.000	0.058	2.00
	9.180		-128.97	-128.9	9.180	0.058	2.00
	10.000		-177.48	-177.4	10.000	0.058	2.00

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7,9)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 9X2E0223	4.008	4.012	163.9	0.0047	2.00
	6.865	6.870	-5.6	0.0085	2.00
	9.181	9.182	-140.2	0.014	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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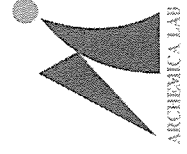
Worakorn

Qualification Report

PM Check list, CM_OQ and PQ
ICS-1100 : Anion (ID#377)

For

Thai Environmental Technic Co., Ltd
(2nd Contract)



ARCHEMICA LAB CO., LTD.

39 Soi Sukhumvit 63 (Ekamai) Sukhumvit Rd.,
North Klongton, Wattana, Bangkok 10110
Tel. (66)-2714-8399 (Automatic) Fax. (66)-2714-8393



Certificate of Calibration

ICS-1100 : Anion (ID#377)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

ICS-1100 S/N : 10010987

AS-DV S/N : 10010912

for

Thai Environmental Technic Co., Ltd



Operator Signature : *K. Chanarong Khiao-Un* Date : Sep 29, 2023

(Mr. Chanarong Khiao-Un)

Test Engineer

PM

Preventive Maintenance
Check List



Checklist ICS Preventive Maintenance

Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization		Name/ Department
Thai Environmental Technic Co.,Ltd		Khun. Ketsarin
Engineer	Date	
Mr.Channarong Khiao-Un	29-Sep-2023	

Instrument Detail

Instrument Model	Application	
ICS-1100 (ID#377)	Anion	
Instrument components		
ICS-1100	Serial Number	10010987
AS-DV		10010912

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22	AG22	AERS 500	-	-

Remark:



Perform By
Archemica Lab Co.,Ltd

ARCHEMICALAB
THAI ENVIRONMENTAL TECHNIC CO.,LTD.
K. CHANNARONG

Archemica Lab

Customer

Date

Date

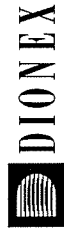


General ICS Maintenance Checklist

Item	Description	Result		Recommended replacement	N.A.
		Check	Fail		
1	Power line 220 Vac	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
2	Pneumatic Line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
3	Pressure outlet 80-100 psi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
4	Barbed fitting and tee fitting	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
5	Crimped and blocked tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
6	Check Rheodyne Valve for Leak <ul style="list-style-type: none">• Stator face• Rotor Seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 12 months Every 12 months	<input type="checkbox"/> <input type="checkbox"/>
		<input checked="" type="checkbox"/>	<input type="checkbox"/>		
7	Slider valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
8	Inspect slider	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
9	Inspect port face	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
10	Inspect pressure bolt	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
11	Inspect fitting and ferrule	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
12	Suppressor for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
13	Cell for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
14	Electronic cable connected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
15	Column selection valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
16	Inspect all fitting and line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
17	Check Eluent reservoir	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
18	Inspect cap o-ring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
19	Inspect air for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
20	Pump Piston Rinse Seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
21	Piston Seals	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
22	Pump Lubricate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check&Lubricate	<input type="checkbox"/>
23	Front panel test	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
24	Low limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
25	Hi limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
26	Conductivity electronic test 160+/-1 uS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
27	Check noise for suppressor (pk to pk <0.005uS)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
28	Check column <ul style="list-style-type: none">• Check bed support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
29	Check pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
30	Check suppressor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
31	Check cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
32	Check leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
33	Flow rate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
34	System pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
35	Detector background	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>

CM OQ

Chromeleon Operation Qualification



Chromeleon Operational Qualification


General Information

Computer Name (Server): NS
Computer Name (Client): TET
Version Number: 6.80 SR8 Build 2623 (156243)
Operator: Mr. Chamarong Khiao-Un

General System Suitability Test: *Test passed*

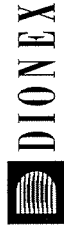
Comparison Formats:

All Parameters: (Exceptions see below)	Significant Digits: (They must match exactly)	10
Time Related Frac. Coli. Parameters: [The parameters are marked with *].]	Max. Deviation:	0.02 s


K. Chamarong Khiao-Un
ACREDITED LAB
VIRAL ESTIMATION AND VIRAL
ASSAYS LAB CULTURE

Reviewer's Signature // Date

Operator's Signature // Date

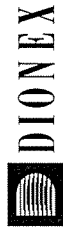


Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

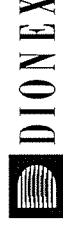
Report Variable	Peak Name	Status
Offset (c0)	n.a. n.a. n.a.	ok ok ok
Slope (c1)	Methylparabene Ethylparabene Propylparabene	ok ok ok
Correlation Coeffi.	Methylparabene Ethylparabene Propylparabene	ok ok ok
Variance	Methylparabene Ethylparabene Propylparabene	ok ok ok
Std. Deviation	Methylparabene Ethylparabene Propylparabene	ok ok ok
Rel. Std. Dev.	Methylparabene Ethylparabene Propylparabene	ok ok ok
Variance Coeff.	Methylparabene Ethylparabene Propylparabene	ok ok ok



Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Calibration Point Y	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Amount [ng]	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Resolution (EP)	Methylparabene	ok
	Ethylparabene	ok
Resolution (USP)	Methylparabene	ok
	Ethylparabene	ok
Peak Asymmetry (EP/USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Peak Asymmetry (AIA)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok



Chromeleon Operational Qualification, Part 1

Verification of Selected Results

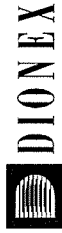
Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Test Result: **Passed**

ARCHITECTALAB
ARCHITECTURAL
LABORATORY
ARCHITECTURAL
CLUB

Reviewer's Signature // Date

Operator's Signature // Date

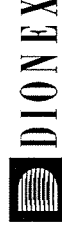


Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Calibration Type: LOf
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

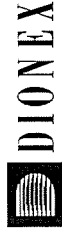
Variable Category	Report Variable	Peak Name	Status
Sample	No.		ok
	Name		ok
	Sample Type		ok
	Position		ok
	Status		ok
	Inj.Vol.		ok
	Dil.Fac.		ok
	Weight		ok
	Amount		ok
	Program		ok
	Quantification Method		ok
	Channel		ok
	No. of Peaks		ok
	Start Time		ok
Chromatogram	Signal Min.		ok
	Signal Max.		ok
	Signal Dimension		ok
	Noise 2.1-2.3		ok
	No.	Methylparabene	ok
	No.	Ethylparabene	ok
	No.	Propylparabene	ok
	Peak Name	Methylparabene	ok
	Peak Name	Ethylparabene	ok
	Ret.Time	Methylparabene	ok
Peak Results	Ret.Time	Ethylparabene	ok
		Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

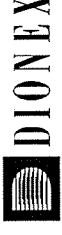
Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dev.(abs)	Methylparabene	ok
	Ret.Dev.(abs)	Ethylparabene	ok
	Ret.Dev.(abs)	Propylparabene	ok
	Ret.Dev.(rel)	Methylparabene	ok
	Ret.Dev.(rel)	Ethylparabene	ok
	Ret.Dev.(rel)	Propylparabene	ok
	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Rel.Area (Total)	Methylparabene	ok
	Rel.Area (Total)	Ethylparabene	ok
	Rel.Area (Total)	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Rel.Height (Total)	Methylparabene	ok
	Rel.Height (Total)	Ethylparabene	ok
	Rel.Height (Total)	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Concentration	Methylparabene	ok
	Concentration	Ethylparabene	ok
	Concentration	Propylparabene	ok
	Rel.Amount	Methylparabene	ok
	Rel.Amount	Ethylparabene	ok
	Rel.Amount	Propylparabene	ok
	Peak Width (0%)	Methylparabene	ok
	Peak Width (0%)	Ethylparabene	ok
	Peak Width (0%)	Propylparabene	ok
	Peak Width (5%)	Methylparabene	ok
	Peak Width (5%)	Ethylparabene	ok
	Peak Width (5%)	Propylparabene	ok
	Peak Width (10%)	Methylparabene	ok
	Peak Width (10%)	Ethylparabene	ok
	Peak Width (10%)	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

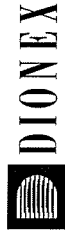
Variable Category/ Peak Results	Report Variable	Peak Name	Status
	Peak Width (50%)	Methylparabene	ok
	Peak Width (50%)	Ethylparabene	ok
	Peak Width (50%)	Propylparabene	ok
	Left Width (0%)	Methylparabene	ok
	Left Width (0%)	Propylparabene	ok
	Right Width (0%)	Methylparabene	ok
	Right Width (0%)	Ethylparabene	ok
	Right Width (0%)	Propylparabene	ok
	Peak Start	Methylparabene	ok
	Peak Start	Ethylparabene	ok
	Peak Start	Propylparabene	ok
	Peak Stop	Methylparabene	ok
	Peak Stop	Ethylparabene	ok
	Peak Stop	Propylparabene	ok
	Peak Start Value	Methylparabene	ok
	Peak Start Value	Ethylparabene	ok
	Peak Start Value	Propylparabene	ok
	Peak Stop Value	Methylparabene	ok
	Peak Stop Value	Ethylparabene	ok
	Peak Stop Value	Propylparabene	ok
	BL-Value Peak Start	Methylparabene	ok
	BL-Value Peak Start	Ethylparabene	ok
	BL-Value Peak Start	Propylparabene	ok
	BL-Value Peak Stop	Methylparabene	ok
	BL-Value Peak Stop	Ethylparabene	ok
	BL-Value Peak Stop	Propylparabene	ok
	Type	Methylparabene	ok
	Type	Ethylparabene	ok
	Type	Propylparabene	ok
	Resolution(EP)	Methylparabene	ok
	Resolution(EP)	Ethylparabene	ok
	Resolution(USP)	Methylparabene	ok
	Resolution(USP)	Ethylparabene	ok
	Asymmetry(EP)	Methylparabene	ok
	Asymmetry(EP)	Ethylparabene	ok
	Asymmetry(EP)	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

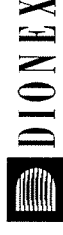
Variable Category/ Peak Results	Report Variable	Peak Name	Status
	Asymmetry(AIA)	Methylparabene	ok
	Asymmetry(AIA)	Ethylparabene	ok
	Asymmetry(AIA)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(EP)	Ethylparabene	ok
	Theoretical Plates(EP)	Propylparabene	ok
	Theoretical Plates(USP)	Methylparabene	ok
	Theoretical Plates(USP)	Ethylparabene	ok
	Theoretical Plates(USP)	Propylparabene	ok
	Theoretical Plates(JP)	Ethylparabene	ok
	Theoretical Plates(JP)	Propylparabene	ok
	Cal.Mode	Methylparabene	ok
	Cal.Mode	Ethylparabene	ok
	Cal.Mode	Propylparabene	ok
	Auto.Recal.	Methylparabene	ok
	Auto.Recal.	Ethylparabene	ok
	Auto.Recal.	Propylparabene	ok
	Cal.Type	Methylparabene	ok
	Cal.Type	Ethylparabene	ok
	Cal.Type	Propylparabene	ok
	Weights	Methylparabene	ok
	Weights	Ethylparabene	ok
	Weights	Propylparabene	ok
	Offset	Methylparabene	ok
	Offset	Ethylparabene	ok
	Offset	Propylparabene	ok
	Slope	Methylparabene	ok
	Slope	Ethylparabene	ok
	Slope	Propylparabene	ok
	RF-Value	Methylparabene	ok
	RF-Value	Ethylparabene	ok
	RF-Value	Propylparabene	ok
	No. of Points	Methylparabene	ok
	No. of Points	Ethylparabene	ok
	No. of Points	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

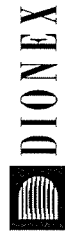
Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propylparabene	ok
	No. of Points(disabled)	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
	Variance	Methylparabene	ok
	Variance	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
	Var.Coeff	Methylparabene	ok
	Var.Coeff	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
Peak Table	Std.Dev.	Methylparabene	ok
	Std.Dev.	Ethylparabene	ok
	Std.Dev.	Propylparabene	ok
	Rel.Std.Dev.	Methylparabene	ok
	Rel.Std.Dev.	Ethylparabene	ok
	Rel.Std.Dev.	Propylparabene	ok
	Corr.Coeff.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Adj. Coeff.Det.	Methylparabene	ok
	Adj. Coeff.Det.	Ethylparabene	ok
	Adj. Coeff.Det.	Propylparabene	ok
	X	Methylparabene	ok
	X	Ethylparabene	ok
	X	Propylparabene	ok
	Y	Methylparabene	ok
	Y	Ethylparabene	ok
	Y	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	W	Propylparabene	ok
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok
	F(X)	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Methylparabene	ok
	Residual for Cal.Point X	Ethylparabene	ok
	Residual for Cal.Point X	Propylparabene	ok
	Calibration Point Status	Methylparabene	ok
	Calibration Point Status	Ethylparabene	ok
	Calibration Point Status	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Amount	Propylparabene	ok
Peak Table	Peak Tab. Cal.Type	Methylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Methylparabene	ok
	Peak Tab. Right Limit	Methylparabene	ok
	Peak Tab. Group	Methylparabene	ok
	Peak Tab. Resp.Factor	Methylparabene	ok
	Peak Tab. Amount	Methylparabene	ok
	Peak Tab. Amnt.Dim	Methylparabene	ok



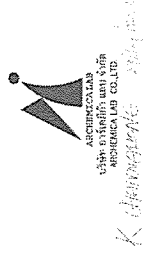
Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Methylparabene	ok
	PPI	Ethylparabene	ok
	PPI	Propylparabene	ok
	RSD PPI	Methylparabene	ok
	RSD PPI	Propylparabene	ok
	RSD PPI	Ethylparabene	ok
	Match	Methylparabene	ok
	Match	Ethylparabene	ok
	Match	Propylparabene	ok
	RSD Match	Methylparabene	ok
	RSD Match	Ethylparabene	ok
	RSD Match	Propylparabene	ok
	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok

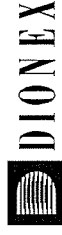
Test Result:

Passed


K. Chongpradit
ARCHIMECA LAB CO., LTD.

Reviewer's Signature // Date

Operator's Signature // Date

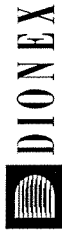


Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel: EXT230NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Base Peak Width	Propylparabene	ok
EXT290NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Base Peak Width	Propylparabene	ok
Smooth Data: UV_VIS_1_MA_005_001 UV_VIS_1_OL_051_001 EXT290NM_SG_005_010	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok



Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Channel Name	Report Variable	Peak Name	Status
Arith. Comb. of Channels:			
ADD_UV_VIS_1 UV_VIS_1	Area	Methylparabene	ok
ADD_UV_VIS_1 UV_VIS_1	Area	Ethylparabene	ok
ADD_UV_VIS_1 UV_VIS_1	Area	Propylparabene	ok
MUL_UV_VIS_1 UV_VIS_1	Area	Methylparabene	ok
MUL_UV_VIS_1 UV_VIS_1	Area	Ethylparabene	ok
MUL_UV_VIS_1 UV_VIS_1	Area	Propylparabene	ok

Test Result:

Passed

Reviewer's Signature // Date

Operator's Signature // Date

ALEXANDER LAB
VĂN TRIỆM HỮU QUÂN
ARCHENCA LAB CO., LTD.



Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

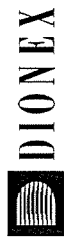
Variable Category	Report Variable	Status
SST	Test No.	ok
	Test Name	ok
	Sample Condition	ok
	Sample Condition Result	ok
	Test Condition	ok
	Peak Condition	ok
	Aggregate Condition	ok
	Compare Operator	ok
	Compare Value	ok
	Result of Compare Value	ok
	Channel	ok
	Aggregated Samples	ok
	List of Aggr. Smp.	ok
	Result List for Aggr. Smp.	ok
	Result of Test Condition or Aggregate	ok
	N.A.	ok
	Test Result	ok
	Fail-Action	ok

Test Result: Passed

Reviewer's Signature // Date

Operator's Signature // Date

ALEXANDER LAB
VĂN TRIỆM HỮU QUÂN
ARCHENCA LAB CO., LTD.



Chromeleon Operational Qualification, Part 5

Fraction Collection: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Status
Fraction Report	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	Position	ok
	Peak Name	ok
Tube Report	No. of Peaks	ok
	Position	ok
	Tube Starttime *)	ok
	Tube Endtime *)	ok
	Max. Tube Volume	ok
	Peak Name	ok
	No. of Peaks	ok
	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	No. of Peaks	ok

K. HANNOGERS
ASCHENHUTZLAB
USDA Forest Service
Forest Sciences Center

Test Result: Passed

Reviewer's Signature // Date

Operator's Signature // Date

PQ

Performance Qualification



Performance Qualification Rev. 6.10

• Instruments

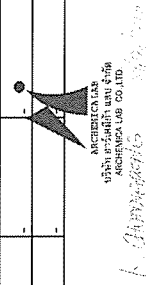
Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0
Chromeleon	6.80 SR8 Build 2623 (156243)	Dionex	16347	n.a.

• Accessories

Name	Description	Lot / Serial	Exp. Date
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	Thermo 230301	Mar-2024
Sample 2	Nitrate, 10 ppm	Thermo 230301	Mar-2024
Sample 3	Nitrate, 25 ppm	Thermo 230301	Mar-2024
Sample 4	Nitrate, 50 ppm	Thermo 230301	Mar-2024
Sample 5	Nitrate, 100 ppm	Thermo 230301	Mar-2024
Sample 6	Nitrate, 1000 ppm	Thermo 230301	Mar-2024
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.
Balance	Mettler Toledo	1116392227	n.a.
Temperature Probe	-	-	-
	-	-	-
	-	-	-

Customer Signature _____ Date _____
Chromeleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Customer Signature _____ Date _____
OO_PQ_Integrated_Validation / Specification
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• Limits

Test	Customized Limits	Dionex Recommended Limits
ICS-1100 Conductivity Noise (nS)	<= 2.0	<= 2.0
ICS-1100 ConductivityDrift (nS/hr)	<= 20	<= 20
Injector Precision (Area %RSD)	<= 1.0	<= 1.0
Injector Carryover (Area %)	<= 0.1	<= 0.1
ICS-1100 Detector Linearity(Corr.)	>= 0.999	>= 0.999
ICS-1100 Detector Linearity(%RSD)	<= 5.0	<= 5.0
ICS-1100 Pump FlowRate Accuracy(mL/min)	<= 0.05	<= 0.05
ICS-1100 Pump FlowRate Precision (%RSD)	<= 2.0	<= 2.0

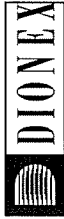
• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date: 29-Sep-2023
Qualification	Mr. Channarong / Archemica	Period between Qualifications: 6 months
Executor/Company:		Next Qualification: Mar-2024

Customer Signature _____ Date _____
Chromeleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Customer Signature _____ Date _____
OO_PQ_Integrated_Validation / Specification
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Performance Qualification Rev. 6.10

Detector Noise and Drift:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0

• Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin/That Environmental Technic Co.,Ltd	Date: 29-Sep-2023
Qualification	Mr. Channarong / Archemica	Next Qualification: Mar-2024

• Test Results Summary

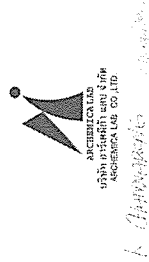
Test	Result
n.a. Conductivity Noise (nS)	PASS
n.a. Conductivity Drift (nS/hr)	PASS

Customer Signature Date

Chromelson (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Executor Signature Date

OQ_PQ_Integrated_Validation / Detector Noise and Drift
Printed: 29/9/2023 1:31 PM



• Data for detector noise

Segment number	Noise, nS
1	0.23
2	0.27
3	0.25
4	0.27
5	0.31
6	0.20
7	0.27
8	0.23
9	0.28
10	0.22
11	0.36
12	0.54
13	0.61
14	0.58
15	0.44
16	1.67
17	1.14
18	0.42
19	0.59
20	1.63
Average, nS	0.5
Limit, nS	2.0
Result	PASS

• Data for detector drift

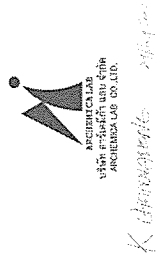
20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
-3.8	11.4	20.0	PASS

Customer Signature Date

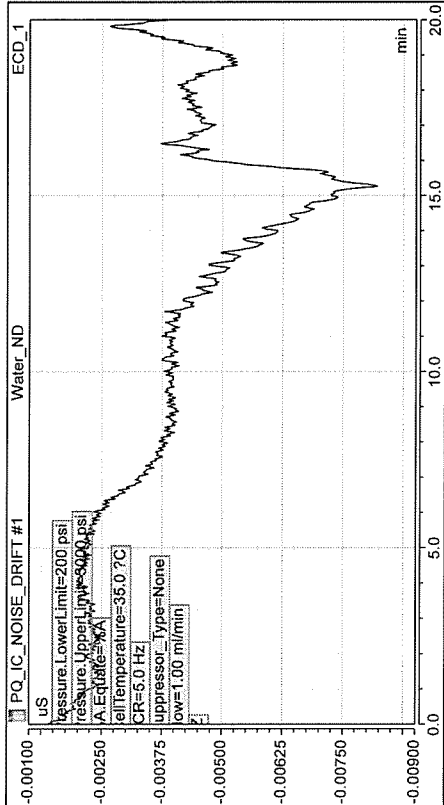
Chromelson (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Executor Signature Date

OQ_PQ_Integrated_Validation / Detector Noise and Drift
Printed: 29/9/2023 1:31 PM



Chromatogram of Detector Noise and Drift



Performance Qualification Rev. 6.10

Injector Precision:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0

• Accessories

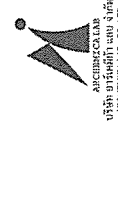
Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Sample 4	Nitrate, 50 ppm	230301
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	29-Sep-2023
Qualification	Mr. Channarong / Archemica	Next Qualification:	Mar-2024

• Test Results Summary

Test	Result
Injector Precision (Area %RSD)	PASS



• Data for Injector Precision test

Name	Area uS*min ECD_1 Nitrate
Inj Precision_1	2.872
Inj Precision_2	2.875
Inj Precision_3	2.882
Inj Precision_4	2.880
Inj Precision_5	2.876
Inj Precision_6	2.887
Inj Precision_7	2.873
Inj Precision_8	2.858
Inj Precision_9	2.857
Inj Precision_10	2.817
Average:	2.868
Std. Dev:	0.020
% RSD:	0.7
Limit (%)	1.0
Result:	PASS

Customer Signature _____ Date _____
Chromeleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)



Executor Signature _____ Date _____
OO_PQ_Integrated Validation / Injector Precision
Printed: 29/9/2023 1:31 PM



Performance Qualification Rev. 6.10

Injector Carryover:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0

• Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Sample 6	Nitrate, 1000 ppm	230301
Blank	Water	n.a.
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	29-Sep-2023
Qualification Executor/Company:	Mr. Channarong / Archchemica	Next Qualification:	Mar-2024

• Test Results Summary

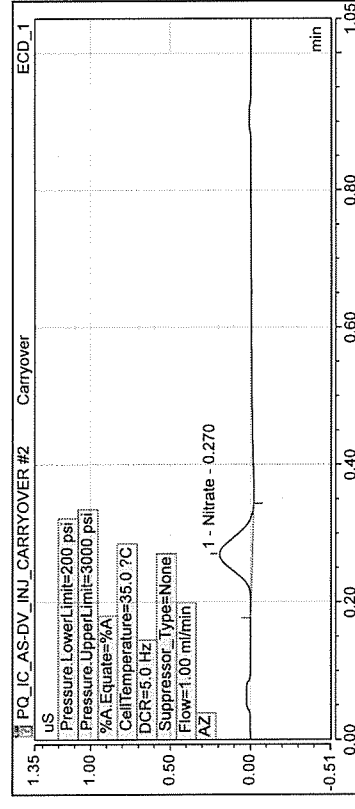
Test	Result
Injector Carryover (Area %)	PASS

Customer Signature _____ Date _____
Chromeleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)



Executor Signature _____ Date _____
OO_PQ_Integrated Validation / Injector Carryover
Printed: 29/9/2023 1:31 PM

• Chromatogram for Carryover test

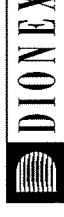


• Data for Carryover test

Name	Ret. Time (detected) min ECD_1 Nitrate	Area uS*min ECD_1 Nitrate
High Level	0.27	50.362
Carryover	0.27	0.012
Water	0.27	0.011
Carryover (%):		0.001
Limit (%):		0.100
Result:		PASS

Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Executor Signature _____ Date _____
OO_PQ_Integrated_VValidation / Injector Carryover
Printed: 29/9/2023 1:31 PM



Performance Qualification Rev. 6.10

Detector Linearity:

• Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

• Accessories

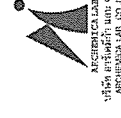
Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Sample 1	Nitrate, 5 ppm	230301
Sample 2	Nitrate, 10 ppm	230301
Sample 3	Nitrate, 25 ppm	230301
Sample 4	Nitrate, 50 ppm	230301
Sample 5	Nitrate, 100 ppm	230301
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co., Ltd	Date:	29-Sep-2023
Qualification			
Executor/Company:	Mr. Channarong / Archemica	Next Qualification:	Mar-2024

• Test Results Summary

Test	Result
n.a. Detector Linearity (Corr.)	PASS
n.a. Detector Linearity (%RSD)	PASS



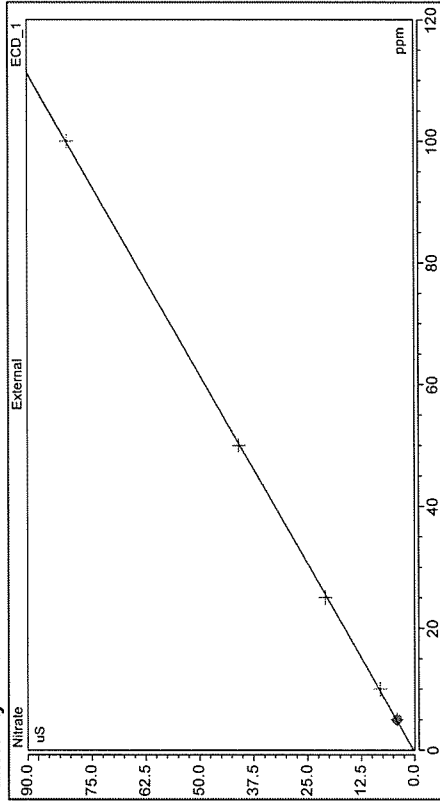
Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Executor Signature _____ Date _____
OO_PQ_Integrated_VValidation / Detector Linearity
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• Data for Detector Linearity

Name	Amount ppm	Height uS
	ECD_1	ECD_1
	Nitrate	Nitrate
Detector linearity_1	5.000	4.101
Detector linearity_2	10.000	8.075
Detector linearity_3	25.000	20.845
Detector linearity_4	50.000	40.788
Detector linearity_5	100.000	80.714

• Linearity Plot



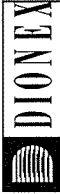
Calibration Type	Number of Points	Offset	Slope
Lin, With-Offset	5	0.269	0.806

Linearly	Correlation Coefficient	% RSD
Limit:	1.000	1.1
Result:	0.999	5.0
	PASS	PASS



Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Executor Signature _____ Date _____
OO_PQ_Integrated_Validation / Detector Linearity
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Performance Qualification Rev. 6.10

Pump Flow Rate Accuracy and Precision Test:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

• Accessories

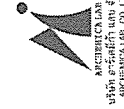
Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Eluent	Water	n.a.
Balance	Mettler Toledo	AB204
		1116392227

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,L	Date:	29-Sep-2023
Qualification	Mr. Channarong / Arche mica	Next Qualification:	Mar-2024

• Test Results Summary

Test	Result
n.a. Pump Flow Rate Accuracy (mL/min)	PASS
n.a. Pump Flow Rate Precision (%RSD)	PASS



Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Executor Signature _____ Date _____
OO_PQ_Integrated_Validation / Pump Flow Rate
Printed: 29/9/2023 1:31 PM

Certificate of Analysis

Better Separations Through
Better Chemistry

Dionex Nitrate OQ/PQ IC Standards Kit

(Set of 6)

Product Number 060254
Certificate of Analysis

Lot Number 230301

Expiration of Certification
March 2024

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in ≥ 18.2 megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	4.98 \pm 0.01
2	10.10 \pm 0.02
3	25.17 \pm 0.02
4	50.05 \pm 0.05
5	100.6 \pm 1
6	1000 \pm 2



The concentration value is based on a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078690-01 20-Dec-2011

thermoscientific.com/dionex
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XX21149-EN0215S 031316-10

thermo
scientific

Certificate of Completion

This certifies that

Channarong Khiao-Un

Has successfully completed

eLearn: RPG IC-Specific Qualification Se

Valid for 3 years from:

Nov/19/2021



The world leader in serving science

Important note: The certificate is o
Scientific including its subsidiaries



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100

Customer : บริษัท เทคโนโลยีสิ่งแวดล้อมไทย
 Address : 1/6 ถนนรามคำแหง 145,
 แขวงสะพานสูง, เขตสะพานสูง,
 กรุงเทพฯ 10240 TH
 User Name: คุณ กิตติศักดิ์ เนื่องงาม
 Phone: 02-3737799
 E-mail: phornip.p@tet1995.com
 ketsarin.c@tet1995.com

Date Tested: 30-มิ.ค.-66
 Recommendation Recertification
 Period 6 Months
 Recertification Due: 29-ก.ม.-66
 Date Last Certified: 3-ต.ค.-65
 Visit Number: 1 of 2
 TH ONE SOURCE Phone: 081-7316733
 E-mail: thonesource@gmail.com

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
AAAnalyst 100	040S0110503	AA WinLab 3.2

TEST STANDARD USED	PART NUMBER
Copper	N9300183
Filter 0.2 %	MG0-057

Page 1 of 4



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100

SERIAL NUMBER 040S0110503 DATE TESTED 30-มิ.ค.-66

1. OPTIC CHECKS
 A. Optical alignment condition (if necessary) ☐ OK
 B. Condition of Mirrors, Lenses etc. (if necessary) ☐ OK
 C. D2, HCL beam adjust (if necessary) ☐ OK

2. GAS SYSTEM CHECKS
 A. Leak test all internal and external gas box joints ☐ OK
 B. All gas box safety features ☐ OK
 C. Burner system including nebulizer and all o-ring and gasket ☐ OK
 D. Drain system (safety) ☐ F

3. ELECTRONICS CHECKS
 A. Power Supplies
 + 5.00 Vdc \pm 0.2 Vdc + 5.02 Vdc
 + 11.50 Vdc \pm 0.2 Vdc + 11.48 Vdc
 + 15.00 Vdc \pm 1.0 Vdc + 14.99 Vdc
 - 15.00 Vdc \pm 1.0 Vdc -15.06 Vdc
 + 35.00 Vdc \pm 3.0 Vdc +35.13 Vdc

4. WAVELENGTH ACCURACY TEST
 A. Zn Lamp wavelength 213.9 nm \pm 0.3 nm. 213.78 nm.
 B. Fe Lamp wavelength 248.3 nm \pm 0.3 nm. 248.20 nm.
 C. Cu Lamp wavelength 324.8 nm \pm 0.3 nm. 324.83 nm.

Page 2 of 4



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	30-11-66
S. PERFORMANCE TESTS		SPEC.	RESULTS
* A. Neutral density filter checks with Copper (324.8 nm)			
Neutral Density Filter 0.2 ± 10%		0.180	0.173 Abs.
B. AA Baseline noise test with Copper (324.8 nm)			
Integration time = 0.5 seconds			
Replicates = 99 times			
Standard Deviation		≤ 0.001	0.000
C. Flame sensitivity with Copper (324.8nm)			
(5 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner)		≥ 0.25	0.285 Abs.
Stainless steel nebulizer			
%RSD		≤ 0.3	0.18 %



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	30-11-66
Remarks :			

This is to certify that the above tests have been performed and the configuration tested

☒ meets
☐ does not meet

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department TH ONE SOURCE CO., LTD.

Krungchai T.
(Krungchai Treevichien)
Customer Support Engineer



Certificate of Training

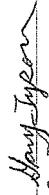
This is to certify that

Mr. Krungchai Treevichien

Has successfully completed

Atomic Absorption 100/300 Service Training

17 September, 2007 TO 21 September, 2007


Gary Tyson
INSTRUCTOR

21 September 2007
Date



PerkinElmer
For the Better

WO-02273746/2023

MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

Customer : บริษัท เทคโนโลยีการแพทย์ไทย จำกัด	Date Tested: April 3, 2023
Address : 1/6 ซอยรามคำแหง 145 แขวงสะพานสูง เขตสะพานสูง กรุงเทพมหานคร 10240	Recommendation Recertification Period 6 Months
User Name: Khun Natapong	Recertification Due: October 3, 2023
Phone: 02-3737799	Date Last Certified: October 4, 2022
Fax:	Visit Number: 1 of 2
	PerkinElmer Phone: 02-719-6420 ext 203
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED	ACCESSORIES/COMPONENT NOT INCLUDED
MODEL OPTIMA 8000	SERIAL NUMBER 078N1310024C
S10	
TESTED EQUIPMENT IPV Methods	CALIBRATION NUMBER EXPIRATION
TEST STANDARD USED Mixed standard 1/10 Mixed standard 1/100	PART NUMBER N069-1579 N930-0221
CUSTOMER SUPPLIED 2 % HNO3 10 % HNO3	EXPIRATION DATE May 30, 2023 November 30, 2023
	CUSTOMER INITIALS



MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078N1310024C

DATE TESTED : April 3, 2023

1. MECHANICAL CHECKS

A. Inspect and clean all fans and filters.

A. ☐

B. Inspect and replace as necessary, all torch components including the RF coil.

B. ☐

C. Inspect all tubing for sign of clacking or leaking.

C. ☐

D. Adjust water and gas pressure regulator settings.

D. ☐

E. Inspect and leak check pneumatics drawers.

E. ☐

F. Clean the exterior of the instrument.

F. ☐

2. OPTICAL CHECKS

A. Inspect and clean all optical components.

A. ☐

B. As required, check and replace all purgebifters.

B. ☐

C. Recheck optical alignment.

C. ☐

3. COOLING SYSTEM CHECKS

A. Perform preventive maintenance on chiller.

A. ☐

B. Flush out the chiller every six months.

B. ☐

4. PERFORMANCE CHECKS

A. Torch View Alignment.

A. ☐

B. Wavelength Calibration.

B. ☐

Page 2 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Khwang Bangkokpi, Khet Huay Kwang, Bangkok 10310, Thailand

WO-02273746/2023

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078N1310024C	DATE TESTED : April 3, 2023	
PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	0.00702
	Ni 231.604 nm	0.00790
	Ni 341.476 nm	0.01192
Spectral Resolution : VIS	Ba 455.403 nm	0.01500
Precision	Zn 206.200 nm	% RSD < 1.0
	Mg 280.271 nm	% RSD < 1.0
	Mg 285.213 nm	% RSD < 1.0
	Ba 455.403 nm	% RSD < 1.0
Detection Limits : Axial	As 193.696 nm	3(SD) ppb
	Se 196.026 nm	3(SD) ppb
	Tl 190.801 nm	3(SD) ppb
	Pb 220.353 nm	3(SD) ppb
Detection Limits : Radial	As 193.696 nm	3(SD) ppb
	Zn 213.857 nm	3(SD) ppb
	Mn 257.610 nm	3(SD) ppb
	La 379.478 nm	3(SD) ppb
BEC : Axial (18 X 1000)/(S-IB)	Ba 455.403 nm	3(SD) ppb
	Ba 493.408 nm	3(SD) ppb
BEC : Radial (18 X 1000)/(S-IB)	Mn 257.610 nm	3(SD) ppb
	Mn 257.610 nm	3(SD) ppb

Page 3 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Khwang Bangkokpi, Khet Huay Kwang, Bangkok 10310, Thailand

WO-02273746/2023



MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078N1310024C DATE TESTED : April 3, 2023

Remarks :

Commissioning follow as commissioning performance sheets.

☒

meets

☐

does not meet

This is to certify that the above tests have been performed and the configuration tested

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department PerkinElmer Ltd.

Authorized Representative :  (Wiphon Promlumda) Service Engineer

Align View XY Axial for analyte Mn 257.610

X-position Y-position Intensity

-2.0	15.0	2920926.2
-1.6	15.0	4117205.6
-1.2	15.0	5581541.7
-0.8	15.0	6990827.7
-0.4	15.0	8176328.5
0.0	15.0	9075098.4
0.4	15.0	8960265.5
0.8	15.0	8360445.5
1.2	15.0	7467099.0
1.6	15.0	6255831.1
2.0	15.0	5030853.2
0.0	10.0	159365.9
0.0	10.5	241214.9
0.0	11.0	446309.1
0.0	11.5	964275.3
0.0	12.0	1659518.8
0.0	12.5	2781326.3
0.0	13.0	4117574.4
0.0	13.5	5863526.6
0.0	14.0	7007618.7
0.0	14.5	8248882.5
0.0	15.0	8915353.6
0.0	15.5	8830206.3
0.0	16.0	8476274.2
0.0	16.5	7574239.7
0.0	17.0	5916533.5
0.0	17.5	4806692.1
0.0	18.0	3470213.6
0.0	18.5	245999.5
0.0	19.0	1403798.3
0.0	19.5	856886.1
0.0	20.0	457127.2
-0.8	15.0	7399406.7
-0.4	15.0	8255530.6
0.0	15.0	8767341.7
0.4	15.0	8902714.8
0.8	15.0	8341631.7
0.4	13.0	4448485.6
0.4	13.5	5980471.5
0.4	14.0	7305087.4
0.4	14.5	8079824.9
0.4	15.0	9038053.5
0.4	15.5	8965644.2
0.4	16.0	8519954.3
0.4	16.5	7478375.8
0.4	17.0	5956440.9

3/4/2566 10:51:07 aligned for analyte Mn 257.610

X viewing position set to 0.4 mm Having Peak Intensity 9038053.5 for Axial viewing
Y viewing position set to 15.0 mm Having Peak Intensity 9038053.5 for Axial viewing

Align View X Radial for analyte Mn 257.610

X-position Y-position Intensity

-7.0	15.0	23032.5
-6.5	15.0	27006.7
-6.0	15.0	35560.5
-5.5	15.0	57821.4
-5.0	15.0	90935.9
-4.5	15.0	136105.4
-4.0	15.0	206645.2
-3.5	15.0	299882.1
-3.0	15.0	428877.1
-2.5	15.0	589771.2
-2.0	15.0	706184.3
-1.5	15.0	841150.2
-1.0	15.0	1019788.8
-0.5	15.0	1329407.6
0.0	15.0	1381151.1
0.5	15.0	1426400.1
1.0	15.0	1309824.4

1.5 15.0 1099234.2
2.0 15.0 784376.5
2.5 15.0 574061.3
3.0 15.0 437455.8
3.5 15.0 324105.7
4.0 15.0 264022.3
4.5 15.0 183005.6
5.0 15.0 117089.3
5.5 15.0 70743.1
6.0 15.0 40927.8
6.5 15.0 27379.1
7.0 15.0 20863.3

3/4/2566 10:54:00 aligned for analyte Mn 257.610

X viewing position set to 0.5 mm having Peak intensity 1426400.1 for Radial viewing

Method Loaded
Method Name: DLRL-Cal
IFC File:
Method Description: C8000-Calibration for later test

Sequence No.: 1
Sample ID: Calib Blank 1
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:
Autosampler Location:
Date Collected: 3/4/2566 11:18:12
Data Type: Reprocessed on 3/4/2566 11:32:52
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: Calib Blank 1
Analyte Back Pressure Flow
All 197.0 kPa 0.50 L/min

Mean Data: Calib Blank 1
Analyte Mean Corrected Std.Dev. RSD Calib
As 193.696 Intensity 96.5 Conc. Units
Zn 213.857 584.3 [0.00] mg/L
Mn 257.610 1401.8 [0.00] mg/L
La 379.478 352.7 [0.00] mg/L
Ba 455.403 25802.4 [0.00] mg/L
Ba 493.408 45750.3 [0.00] mg/L

Sequence No.: 2
Sample ID: Calib Std 1
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:
Autosampler Location:
Date Collected: 3/4/2566 10:55:27
Data Type: Reprocessed on 3/4/2566 11:32:52
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: Calib Std 1
Analyte Back Pressure Flow
All 194.0 kPa 0.50 L/min

Mean Data: Calib Std 1
Analyte Mean Corrected Std.Dev. RSD Calib
As 193.696 Intensity 13655.9 Conc. Units
Zn 213.857 149844.9 [5.0] mg/L
Mn 257.610 1615840.4 [1.0] mg/L
La 379.478 340770.3 [1.0] mg/L
Ba 455.403 839940.7 [0.1] mg/L
Ba 493.408 633243.6 [0.1] mg/L

Calibration Summary

Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.	Reslope
As 193.696	1	Lin, Calc Int	0.0	2731	0.00000	1.000000	
Zn 213.857	1	Lin, Calc Int	0.0	149800	0.00000	1.000000	
Mn 257.610	1	Lin, Calc Int	0.0	1616000	0.00000	1.000000	
La 379.478	1	Lin, Calc Int	0.0	340800	0.00000	1.000000	
Ba 455.403	1	Lin, Calc Int	0.0	8399000	0.00000	1.000000	
Ba 493.408	1	Lin, Calc Int	0.0	6332000	0.00000	1.000000	

Sequence No.: 3
Sample ID: IDL-RL (2% HNO3)
Logged In Analyst (Original) : TET
Initial Sample Wt:
Autosampler Location:
Date Collected: 3/4/2566 11:19:52
Data Type: Reprocessed on 3/4/2566 11:32:52
Initial Sample Vol:

Dilution: 3X
Wash Time:

Sample Prep Vol:

Nebulizer Parameters: IDL-XL (2% HNO3)

Analyte Back Pressure Flow
All 198.0 kPa 0.50 L/min

Mean Data: IDL-XL (2% HNO3)

Analyte	Mean Corrected Intensity	Conc. Units	Std.Dev.	Sample Conc. Units	Std.Dev.	RSD
As 193.696	-32.0	-0.0 mg/L	0.00	-35.2 µg/L	2.60	7.40%
Zn 213.857	37.4	0.0 mg/L	0.00	0.7 µg/L	0.26	35.07%
Mn 257.610	475.9	0.0 mg/L	0.00	0.9 µg/L	1.49	168.85%
La 379.478	-36.3	-0.0 mg/L	0.00	-0.3 µg/L	1.12	350.55%
Ba 455.403	26579.4	0.0 mg/L	0.00	9.5 µg/L	2.86	30.09%
Ba 493.408	-20698.9	-0.0 mg/L	0.00	-9.8 µg/L	9.64	98.34%

Reprocessing Begun

Logged In Analyst: TET

Technique: ICP Continuous

Results Data Set (original): PM3APR23

Results Library (original): C:\Users\Public\PerkinElmer\IPV\Results.mdb

Results Data Set (reprocessed):

Results Library (reprocessed):

Sequence No.: 1

Autosampler Location:

Sample ID: Calib Blank 1 Date Collected: 3/4/2566 11:23:46

Analyst: Logged In Analyst (Original) : TET Date Type: Reprocessed on 3/4/2566 11:32:04

Initial Sample Wt:

Initial Sample Vol:

Sample Prep Vol:

Wash Time:

Nebulizer Parameters: Calib Blank 1

Analyte Back Pressure Flow
All 198.0 kPa 0.50 L/min

Mean Data: Calib Blank 1

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Calib Conc. Units
Tl 190.801	-113.3			[0.00] µg/L	[0.00] µg/L
As 193.696	285.4			[0.00] µg/L	[0.00] µg/L
Se 196.026	99.6			[0.00] µg/L	[0.00] µg/L
Pb 220.353	1176.2			[0.00] µg/L	[0.00] µg/L

Sequence No.: 2

Autosampler Location:

Sample ID: DL-Standard Date Collected: 3/4/2566 11:29:24

Analyst: Logged In Analyst (Original) : TET Date Type: Reprocessed on 3/4/2566 11:32:04

Initial Sample Wt:

Initial Sample Vol:

Sample Prep Vol:

Wash Time:

Nebulizer Parameters: DL-Standard

Analyte Back Pressure Flow
All 199.0 kPa 0.50 L/min

Mean Data: DL-Standard

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Calib Conc. Units
Tl 190.801	19454.6			[1000] µg/L	[1000] µg/L
As 193.696	17563.5			[1000] µg/L	[1000] µg/L
Se 196.026	4574.6			[500] µg/L	[500] µg/L
Pb 220.353	31327.5			[500] µg/L	[500] µg/L

Calibration Summary

Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.	Reslope
Tl 190.801	1	Lin, Calc Int	0.0	19.45	0.00000	1.000000	
As 193.696	1	Lin, Calc Int	-0.0	17.56	0.00000	1.000000	
Se 196.026	1	Lin, Calc Int	0.0	9.119	0.00000	1.000000	
Pb 220.353	1	Lin, Calc Int	0.0	62.65	0.00000	1.000000	

Sequence No.: 3

Autosampler Location:

Sample ID: IDL-XL (2% HNO3) Date Collected: 3/4/2566 11:25:37

Analyst: Logged In Analyst (Original) : TET Date Type: Reprocessed on 3/4/2566 11:32:04

Initial Sample Wt:

Initial Sample Vol:

Sample Prep Vol:

Wash Time:

Nebulizer Parameters: IDL-XL (2% HNO3)

Analyte Back Pressure Flow
All 198.0 kPa 0.50 L/min

Mean Data: IDL-XL (2% HNO3)

Analyte	Mean Corrected Intensity	Conc. Units	Std.Dev.	Sample Conc. Units	Std.Dev.	RSD
Tl 190.801	35.1	2 µg/L	1.24	5 µg/L	3.73	68.95%
As 193.696	-14.0	-1 µg/L	1.42	-2 µg/L	4.26	177.97%
Se 196.026	-6.5	-1 µg/L	0.96	-2 µg/L	2.87	134.85%
Pb 220.353	-135.0	-2 µg/L	3.83	-6 µg/L	11.48	177.50%

Method: MBEC

Method Loaded

Method Name: MBEC

MSF File:

Method Last Saved: 15/10/2563 10:51:07

Method Description: C8000-XL and RL-Spec <or = 30 µg/L,Attn:Spec<or= 50µg/L

Autosampler Location:

Sequence No.: 1

Sample ID: IB (2% HNO3)

Date Collected: 3/4/2566 11:17:14

Data Type: Reprocessed on 3/4/2566 11:32:27

Logged in Analyst (Original) : TET

Initial Sample Vol:

Dilution:

Wash Time:

Nebulizer Parameters: IB (2% HNO3)

Analyte Back Pressure Flow

All 197.0 kPa 0.50 L/min

Mean Data: IB (2% HNO3)

Mean Corrected Intensity

Conc. Units

Calib.

Sample Conc. Units

Std.Dev.

Std.Dev.

RSD

Analyte

Mn 257 XN

Mn 257 RN

39181.6

Sequence No.: 2

Sample ID: IS (N069-1579/10)

Autosampler Location:

Date Collected: 3/4/2566 10:57:10

Data Type: Reprocessed on 3/4/2566 11:32:27

Logged in Analyst (Original) : TET

Initial Sample Vol:

Dilution:

Wash Time:

Nebulizer Parameters: IS (N069-1579/10)

Analyte Back Pressure Flow

All 194.0 kPa 0.50 L/min

Mean Data: IS (N069-1579/10)

Mean Corrected Intensity

Conc. Units

Calib.

Sample Conc. Units

Std.Dev.

Std.Dev.

RSD

Analyte

Mn 257 XN

Mn 257 RN

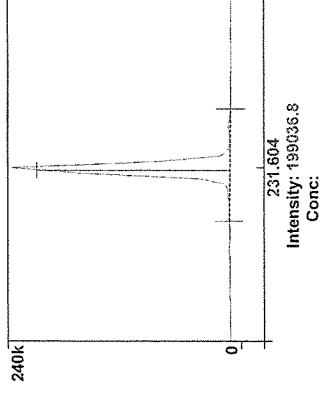
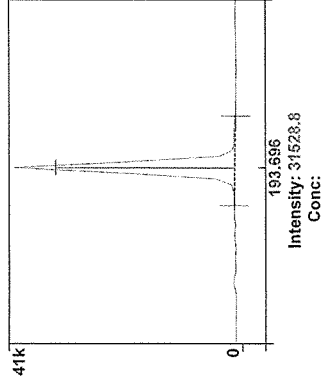
11636268.0

1679271.0

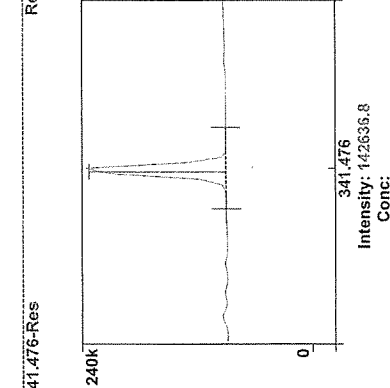
AS	193.696-Res	Rep 1	Res: 0.00701
AS	193.696-Res	Rep 2	Res: 0.00702
AS	193.696-Res	Rep 3	Res: 0.00789
NI	231.604-Res	Rep 1	Res: 0.00790
NI	231.604-Res	Rep 2	Res: 0.00790
NI	231.604-Res	Rep 3	Res: 0.00790
NI	341.476-Res	Rep 1	Res: 0.01188
NI	341.476-Res	Rep 2	Res: 0.01192
NI	341.476-Res	Rep 3	Res: 0.01166
BA	455.403-Res	Rep 1	Res: 0.01499
BA	455.403-Res	Rep 2	Res: 0.01495
BA	455.403-Res	Rep 3	Res: 0.01500

Method: Resolution
Result: PW3APR23

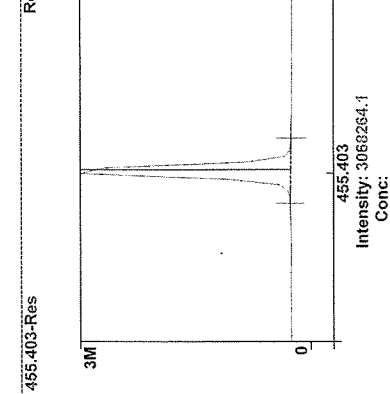
As 193.696-Res Rep: 3 Ni 231.604-Res Rep: 3



1 Ni 341.476-Res



2 Ba 455.403-Res



3

4

```

Method Loaded
Method Name: Precision
IEC File:
Method Description: C8000-N=10- 1.0% RSD

Method Last Saved: 3/5/2554 12:31:51
MSF File:

Autosampler Location:
Sample ID: RSD STD
Sequence No.: 4
Date Collected: 3/4/2566 11:02:43
Analyst:
Data Type: Original
Initial Sample Vol:
Initial Sample Wt:
Dilution:
Sample Prep Vol:
Wash Time:

```

```
-----
Nebulizer Parameters: RSD STD (N069-1579/10)
Analyte      Back Pressure  Flow
All          195.0 kPa    0.50 L/min
-----
```

Mean Data: RSD STD (N069-1579/10)					
Analyte	Mean	Corrected Intensity	Calib. Conc. Units	Std.Dev.	Sample Conc. Units
Zn 206.200	493474.3			17093.12	3.46%
Mg 280.271	3275340.1			23266.88	0.71%
Mg 285.213	196113.7			11109.46	5.66%
Ba 455.403	7794526.3			80474.48	1.03%

```
Method Loaded
Method Name: Precision
IEC File:
Method Description: C8000 -N=10- 1.0% RSD
Method Last Saved: 3/4/2556 11:07:51
MSF File:
```

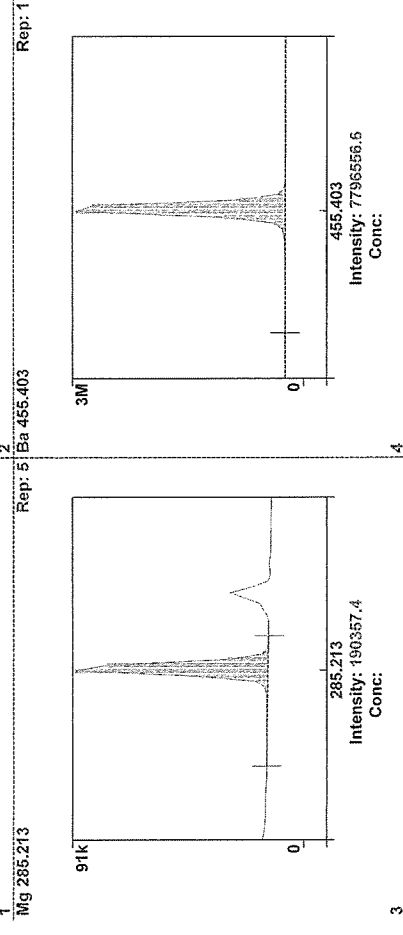
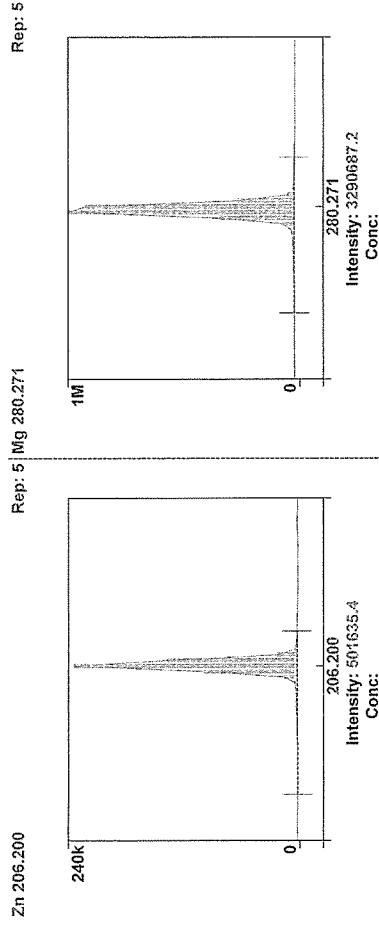
Sequence No.: 5
Sample ID: RSD STD (N069-1579/10)
Analyst:
Initial Sample Wt:
Dilution:
Autosampler Location:
Date Collected: 3/4/2566 11:08:51
Data Type: Original
Initial Sample Vol:
Sample Prep Vol:

```

-----
Nebulizer Parameters: RSD STD (N069-1579/10)
Analyte      Back Pressure  Flow
All          196.0 kPa      0.50 L/min
-----

```

Mean Data: RSD STD (N069-1579/10)					
Analyte	Intensity	Mean Corrected	Calib.	Std. Dev.	Sample
			Conc. Units		Conc. Units
Zn 206.200					
Mg 280.271	515663.2			2890.08	0.56%
Mg 285.213	304809.8			43469.63	0.28%
Ba 455.403	197460.0			775.34	0.39%
	8071203.3			31631.19	0.39%





PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N0691579
Description: Multi-Element Standard
Matrix: 2% HNO₃
Lot Number: 57-024CRX1

Certification Date: NOV -- 2021
Expiration Date: MAY 3 0 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	50.1 µg/mL	3103a*
K	50.0 µg/mL	50.3 µg/mL	3141a*
La	10.0 µg/mL	10.0 µg/mL	3127a*
Li	10.0 µg/mL	10.0 µg/mL	3128a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*
Ni	10.0 µg/mL	10.0 µg/mL	3136*
Sr	10.0 µg/mL	10.0 µg/mL	3153a*
Zn	10.0 µg/mL	10.0 µg/mL	3166a*
Ba	1.00 µg/mL	1.01 µg/mL	3104a*
Mg	1.00 µg/mL	1.01 µg/mL	3131a*

* - indicates NIST SRM

† - indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 2-84MJ, 3-168MJ, 4-35MJ

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.
We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer:

Y. Parikh

Certifying Officer:

Y. Parikh



PerkinElmer, Inc.
U.S.A. Tel: 1-203-925-4600
U.S.A. Toll Free: 1-800-762-4000



PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N9300221
Description: Instrument Calibration Standard 4
Matrix: 5% HNO₃
Lot Number: 58-169CRY1

Certification Date: MAY -- 2022
Expiration Date: NOV 3 0 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	100 µg/mL	99.8 µg/mL	3103a*
Ti	100 µg/mL	98.4 µg/mL	3158*
Cd	50.0 µg/mL	50.0 µg/mL	3108*

* - indicates NIST SRM

† - indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 87-156CR, 1-177YJ, 54-134CR

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.
We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer:

Y. Parikh



PerkinElmer, Inc.
U.S.A. Tel: 1-203-925-4600
U.S.A. Toll Free: 1-800-762-4000



PerkinElmer®

Global Service Training Department

Service Engineer Certification

Wiphan Promlunda

**This is to certify that the above mentioned
PerkinElmer representative has been trained to
service the instrument indicated below:**

ICP220B Optima 8300 & Optima 4X/5X/7X00 Series

Instructor:

Geoff Cook

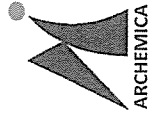
Date: July 20, 2012

Certified by:

(Manager, Global Training Operations)

PM

Preventive Maintenance Check List



ARCHEMICA

Certificate of Calibration

ICS-1100 : Anion (ID#377)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

ICS-1100 S/N : 10010987

AS-DV S/N : 10010912

for

Thai Environmental Technic Co., Ltd



ARCHEMICA LAB
บริษัท อีอาร์เคมีคัล จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature : Nutdanai Laekhwan Date : Mar 30, 2023

(Mr. Nutdanai Laekhwan)

Application Chemist



Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/Department
Thai Environmental Technic Co.,Ltd (1 st Contract)	Khun.Kelsarin
Engineer	Date
Mr.Nutdanai Laekhwan	30-Mar-2023

Instrument Detail

Instrument Model	Application
ICS-1100 (ID#377)	Anion
Instrument components	Serial Number
ICS-1100	10010987
AS-DV	10010912

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22	AG22	AERS 500	-	-
Remark:				



Perform By
Archemica Lab Co.,Ltd

ARCHEMICALAB
ANION CHROMATOGRAPHY
ARCHEMICALAB CO.,LTD.
Nutdanai

Archemica Lab

30-3-23

Date

Customer

Date



General ICS Maintenance Checklist

Item	Description	Result		Recommended replacement	N.A.
		Check	Fail		
1	Power line 220 Vac	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
2	Pneumatic Line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
3	Pressure outlet 80-100 psi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
4	Barbed fitting and tee fitting	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
5	Crimped and blocked tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
6	Check Rheodyne Valve for Leak • Stator face • Rotor Seal	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	Every 12 months Every 12 months	<input type="checkbox"/> <input type="checkbox"/>
7	Slider valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
8	Inspect slider	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
9	Inspect port face	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
10	Inspect pressure bolt	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
11	Inspect fitting and ferrule	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
12	Suppressor for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
13	Cell for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
14	Electronic cable connected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
15	Column selection valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
16	Inspect all fitting and line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
17	Check Eluent reservoir	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
18	Inspect cap o-ring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
19	Inspect air for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
20	Pump Piston Rinse Seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
21	Piston Seals	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
22	Pump Lubricate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check&Lubricate	<input type="checkbox"/>
23	Front panel test	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
24	Low limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
25	Hi limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
26	Conductivity electronic test 160+/-1 uS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
27	Check noise for suppressor (pk to pk <0.005uS)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
28	Check column • Check bed support	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
29	Check pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
30	Check suppressor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
31	Check cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
32	Check leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
33	Flow rate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
34	System pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
35	Detector background	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>

CM OQ

Chromeleon Operation Qualification

Seq: TET12nd Con 30-Mar-23\CM_OQ 30-3-2023\CM_OQ
Smp: Parabenes

Page 1 of 15
Runtime: 30/3/23 11:05:39 AM



Chromeleon Operational Qualification

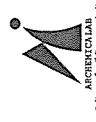
General Information

Computer Name (Server): NS
Computer Name (Client): TET
Version Number: 6.80 SR8 Build 2623 (156243)
Operator: Mr. Nutdanai Laekhwan

General System Suitability Test: *Test passed*

Comparison Formats:

All Parameters: (Exceptions see below)	Significant Digits: (They must match exactly)	10
Time Related Frac. Coll. Parameters: [The parameters are marked with *.]	Max. Deviation:	0.02 s



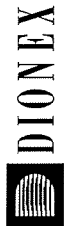
Nutdanai 30-3-23

Reviewer's Signature // Date

Operator's Signature // Date

Chromeleon (c) DIONEX 2006
Version 6.80 SR8 Build 2623 (156243)

CM_OQ / General Information
Printed: 30/3/23 1:22 PM

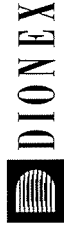


Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Report Variable	Peak Name	Status
Offset (c0)	n.a.	ok
	n.a.	ok
	n.a.	ok
Slope (c1)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Correlation Coeff.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Std. Deviation	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Rel. Std. Dev.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance Coeff.	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok



Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Calibration Point Y	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Amount [ng]	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Resolution (EP)	Methylparabene	ok
	Ethylparabene	ok
Resolution (USP)	Methylparabene	ok
	Ethylparabene	ok
Peak Asymmetry (EPIUSP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Peak Asymmetry (AIA)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok



Chromeleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

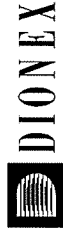
Test Result:

Passed

Reviewer's Signature // Date

Operator's Signature // Date

ARCHITECTURAL
DESIGN CONSULTING
ARCHITECTS LTD. CO., LTD.
30-3-23



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Peak Name	Status
Sample	No.		ok
	Name		ok
	Sample Type		ok
	Position		ok
	Status		ok
	Inj.Vol.		ok
	Dil.Fac.		ok
	Weight		ok
	Amount		ok
	Program		ok
Chromatogram	Quantification Method		ok
	Channel		ok
	No. of Peaks		ok
	Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Signal Dimension		ok
	Noise 2.1-2.3		ok
	No.	Methylparabene	ok
	No.	Ethylparabene	ok
Peak Results	No.	Propylparabene	ok
	Peak Name	Methylparabene	ok
	Peak Name	Ethylparabene	ok
	Peak Name	Propylparabene	ok
	Ret. Time	Methylparabene	ok
	Ret. Time	Ethylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

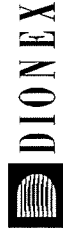
Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dev.(abs)	Methylparabene	ok
	Ret.Dev.(abs)	Ethylparabene	ok
	Ret.Dev.(abs)	Propylparabene	ok
	Ret.Dev.(rel)	Methylparabene	ok
	Ret.Dev.(rel)	Ethylparabene	ok
	Ret.Dev.(rel)	Propylparabene	ok
	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Rel.Area (Total)	Methylparabene	ok
	Rel.Area (Total)	Ethylparabene	ok
	Rel.Area (Total)	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Rel.Height (Total)	Methylparabene	ok
	Rel.Height (Total)	Ethylparabene	ok
	Rel.Height (Total)	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Concentration	Propylparabene	ok
	Concentration	Methylparabene	ok
	Concentration	Ethylparabene	ok
	Concentration	Propylparabene	ok
	Rel.Amount	Methylparabene	ok
	Rel.Amount	Ethylparabene	ok
	Rel.Amount	Propylparabene	ok
	Peak Width (0%)	Methylparabene	ok
	Peak Width (0%)	Ethylparabene	ok
	Peak Width (0%)	Propylparabene	ok
	Peak Width (5%)	Methylparabene	ok
	Peak Width (5%)	Ethylparabene	ok
	Peak Width (5%)	Propylparabene	ok
	Peak Width (10%)	Methylparabene	ok
	Peak Width (10%)	Ethylparabene	ok
	Peak Width (10%)	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

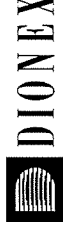
Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Methylparabene	ok
	Peak Width (50%)	Ethylparabene	ok
	Peak Width (50%)	Propylparabene	ok
	Left Width (0%)	Methylparabene	ok
	Left Width (0%)	Ethylparabene	ok
	Left Width (0%)	Propylparabene	ok
	Right Width (0%)	Methylparabene	ok
	Right Width (0%)	Ethylparabene	ok
	Right Width (0%)	Propylparabene	ok
	Peak Start	Methylparabene	ok
	Peak Start	Ethylparabene	ok
	Peak Start	Propylparabene	ok
	Peak Stop	Methylparabene	ok
	Peak Stop	Ethylparabene	ok
	Peak Stop	Propylparabene	ok
	Peak Start Value	Methylparabene	ok
	Peak Start Value	Ethylparabene	ok
	Peak Start Value	Propylparabene	ok
	Peak Stop Value	Methylparabene	ok
	Peak Stop Value	Ethylparabene	ok
	Peak Stop Value	Propylparabene	ok
	BL-Value Peak Start	Methylparabene	ok
	BL-Value Peak Start	Ethylparabene	ok
	BL-Value Peak Start	Propylparabene	ok
	BL-Value Peak Stop	Methylparabene	ok
	BL-Value Peak Stop	Ethylparabene	ok
	BL-Value Peak Stop	Propylparabene	ok
	Type	Methylparabene	ok
	Type	Ethylparabene	ok
	Type	Propylparabene	ok
	Resolution(EP)	Methylparabene	ok
	Resolution(EP)	Ethylparabene	ok
	Resolution(USP)	Methylparabene	ok
	Resolution(USP)	Ethylparabene	ok
	Asymmetry(EP)	Methylparabene	ok
	Asymmetry(EP)	Ethylparabene	ok
	Asymmetry(EP)	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Methylparabene	ok
	Asymmetry(AIA)	Ethylparabene	ok
	Asymmetry(AIA)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(EP)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(USP)	Methylparabene	ok
	Theoretical Plates(USP)	Ethylparabene	ok
	Theoretical Plates(USP)	Propylparabene	ok
	Theoretical Plates(JP)	Methylparabene	ok
	Theoretical Plates(JP)	Ethylparabene	ok
	Theoretical Plates(JP)	Propylparabene	ok
	Cal.Mode	Methylparabene	ok
	Cal.Mode	Ethylparabene	ok
Peak Calibration	Cal.Mode	Propylparabene	ok
	Auto.Recal.	Methylparabene	ok
	Auto.Recal.	Ethylparabene	ok
	Auto.Recal.	Propylparabene	ok
	Cal.Type	Methylparabene	ok
	Cal.Type	Ethylparabene	ok
	Cal.Type	Propylparabene	ok
	Weights	Methylparabene	ok
	Weights	Ethylparabene	ok
	Weights	Propylparabene	ok
	Offset	Methylparabene	ok
	Offset	Ethylparabene	ok
	Offset	Propylparabene	ok
	Slope	Methylparabene	ok
	Slope	Ethylparabene	ok
	Slope	Propylparabene	ok
	RF-Value	Methylparabene	ok
	RF-Value	Ethylparabene	ok
	RF-Value	Propylparabene	ok
	No. of Points	Methylparabene	ok
	No. of Points	Ethylparabene	ok
	No. of Points	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

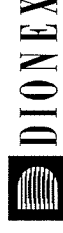
Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propylparabene	ok
	No. of Points(disabled)	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
	Variance	Methylparabene	ok
	Variance	Ethylparabene	ok
	Variance	Propylparabene	ok
	Var.Coeff	Methylparabene	ok
	Var.Coeff	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
	Std.Dev.	Methylparabene	ok
	Std.Dev.	Ethylparabene	ok
	Std.Dev.	Propylparabene	ok
	Rel.Std.Dev.	Methylparabene	ok
	Rel.Std.Dev.	Ethylparabene	ok
	Rel.Std.Dev.	Propylparabene	ok
	Corr.Coeff.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coef.Det.	Methylparabene	ok
	Coef.Det.	Ethylparabene	ok
	Coef.Det.	Propylparabene	ok
	Adj. Coeff.Det.	Methylparabene	ok
	Adj. Coeff.Det.	Ethylparabene	ok
	Adj. Coeff.Det.	Propylparabene	ok
	X	Methylparabene	ok
	X	Ethylparabene	ok
	X	Propylparabene	ok
	Y	Methylparabene	ok
	Y	Ethylparabene	ok
	Y	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	W	Propylparabene	ok
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok
	F(X)	Propylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Methylparabene	ok
	Residual for Cal.Point X	Ethylparabene	ok
	Residual for Cal.Point X	Propylparabene	ok
	Calibration Point Status	Methylparabene	ok
	Calibration Point Status	Ethylparabene	ok
	Calibration Point Status	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Amount	Propylparabene	ok
Peak Table	Peak Tab. Cal.Type	Methylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Methylparabene	ok
	Peak Tab. Right Limit	Methylparabene	ok
	Peak Tab. Group	Methylparabene	ok
	Peak Tab. Resp.Factor	Methylparabene	ok
	Peak Tab. Amnt.Dim	Methylparabene	ok



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Methylparabene	ok
	PPI	Ethylparabene	ok
	PPI	Propylparabene	ok
	RSD PPI	Methylparabene	ok
	RSD PPI	Ethylparabene	ok
	RSD PPI	Propylparabene	ok
	Match	Methylparabene	ok
	Match	Ethylparabene	ok
	Match	Propylparabene	ok
	RSD Match	Methylparabene	ok
	RSD Match	Ethylparabene	ok
	RSD Match	Propylparabene	ok
	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok
	Rel.Max at	Propylparabene	ok

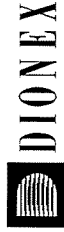
Test Result:

Passed


Nutanai 30-3-23
ARCHIECOLLAB
157th STREET UNIT 610A
VANCOUVER, BC V6N 1C6
CANADA

Reviewer's Signature // Date

Operator's Signature // Date



Chromeleon Operational Qualification, Part 3

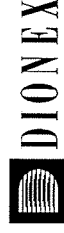
Post-Acquisition Steps: Comparison with Expected Results

Calibration Type:
Integration Type:
Standard Method:
Calibration Mode:
Auto Recalibrate:

LOff
Area
External
Total
ON

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel:			
EXT230NM	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Area	Methylparabene	ok
EXT290NM	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok

Smooth Data:
UV_VIS_1_MA_005_001
UV_VIS_1_OL_051_001
EXT290NM_SG_005_010



Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

Channel Name	Report Variable	Peak Name	Status
Arith. Comb. of Channels:			
ADD_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok

Test Result:

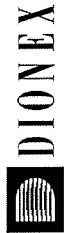
Passed



N. V. Daniel 30-3-23

Operator's Signature // Date

Reviewer's Signature // Date



Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

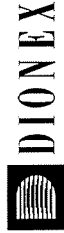
Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Status
SST	Test No.	ok
	Test Name	ok
	Sample Condition	ok
	Sample Condition Result	ok
	Test Condition	ok
	Peak Condition	ok
	Aggregate Condition	ok
	Compare Operator	ok
	Compare Value	ok
	Result of Compare Value	ok
	Channel	ok
	Aggregated Samples	ok
	List of Aggr. Smp.	ok
	Result List for Aggr. Smp.	ok
	Result of Test Condition or Aggregate	ok
	N.A.	ok
	Test Result	ok
	Fail-Action	ok

Test Result: Passed

ARCHIMEC LAB
บริษัท อีซีแอล จำกัด
ARCHIMEC LAB CO., LTD.
NvT ๑๙๙๑ 30-3-23
Operator's Signature // Date

Reviewer's Signature // Date



Chromeleon Operational Qualification, Part 5

Fraction Collection: Comparison with Expected Results

Calibration Type: LOff
Integration Type: Area
Standard Method: External
Calibration Mode: Total
Auto Recalibrate: ON

Variable Category	Report Variable	Status
Fraction Report	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	Position	ok
	Peak Name	ok
	No. of Peaks	ok
Tube Report	Position	ok
	Tube Starttime *)	ok
	Tube Endtime *)	ok
	Max. Tube Volume	ok
	Peak Name	ok
	No. of Peaks	ok
	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	No. of Peaks	ok

Test Result: Passed

ARCHIMEC LAB
บริษัท อีซีแอล จำกัด
ARCHIMEC LAB CO., LTD.
NvT ๑๙๙๑ 30-3-23
Operator's Signature // Date

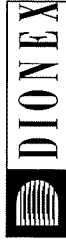
Reviewer's Signature // Date

PQ

Performance Qualification

Sequence: PQ_IC_WARM_UP
Sample: Water_WU

Page 1 of 2
Date: 30/3/2023



Performance Qualification Rev. 6.10

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0
Chromeleon	6.80 SR8 Build 2623 (156243)	Dionex	16347	n.a.

• Accessories

Name	Description	Lot / Serial	Exp. Date
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	Thermo 220701	Jui-2023
Sample 2	Nitrate, 10 ppm	Thermo 220701	Jui-2023
Sample 3	Nitrate, 25 ppm	Thermo 220701	Jui-2023
Sample 4	Nitrate, 50 ppm	Thermo 220701	Jui-2023
Sample 5	Nitrate, 100 ppm	Thermo 220701	Jui-2023
Sample 6	Nitrate, 1000 ppm	Thermo 220701	Jui-2023
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.
Balance	Mettler Toledo AB204	1116392227	n.a.
Temperature Probe	-	-	-
IC Validation Test Box	-	-	-
Anmmeter / Multimeter	-	-	-

Customer Signature
Chromeleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Signature
Date
30-3-23
OQ PQ Integrated Validation / Specification
Printed: 30/3/2023 1:23 PM

• Limits

Test	Customized Limits	Dionex Recommended Limits
ICS-1100 Conductivity Noise (nS)	<= 2.0	<= 2.0
ICS-1100 Conductivity Drift (nS/hr)	<= 20	<= 20
Injector Precision (Area %RSD)	<= 1.0	<= 1.0
Injector Carryover (Area %)	<= 0.1	<= 0.1
ICS-1100 Detector Linearity (Corr.)	>= 0.999	>= 0.999
ICS-1100 Detector Linearity (%RSD)	<= 5.0	<= 5.0
ICS-1100 Pump Flow Rate Accuracy (mL/min)	<= 0.05	<= 0.05
ICS-1100 Pump Flow Rate Precision (%RSD)	<= 2.0	<= 2.0

• Additional Information

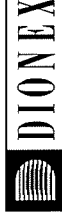
Customer/Company:	Khun.Ketsarin / Thai Environmental Technic Co.,Ltd	Date:	30-Mar-2023
Qualification	Mr. Nutdanai / Archemica	Period between Qualifications:	6 months
Executor/Company:		Next Qualification:	Sep-2023



ผู้ว่าราชการจังหวัดเชียงใหม่
ARCHHEMIC LAB CO.,LTD.

30-3-23

Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)
Executive Signature _____ Date _____
OQ_PQ Integrated Validation / Specification
Printed: 30/3/2023 1:23 PM



Performance Qualification Rev. 6.10

Detector Noise and Drift:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	01234567	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0

• Accessories

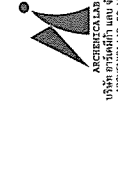
Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin / Thai Environmental Technic Co.,Ltd	Date:	30-Mar-2023
Qualification	Mr. Nutdanai / Archemica	Next Qualification:	Sep-2023
Executor/Company:			

• Test Results Summary

Test	Result
ICS-1100 Conductivity Noise (nS)	PASS
ICS-1100 Conductivity Drift (nS/hr)	PASS



ผู้ว่าราชการจังหวัดเชียงใหม่
ARCHHEMIC LAB CO.,LTD.

30-3-23

Customer Signature _____ Date _____
Chromleon (c) DIONEX 2006
Version 6.80 SR8 Build 2623 (156243)
Executive Signature _____ Date _____
OQ_PQ Integrated Validation / Detector Noise and Drift
Printed: 30/3/2023 1:23 PM

• Data for detector noise

Segment number	Noise, nS
1	1.21
2	0.68
3	1.38
4	0.93
5	1.02
6	0.78
7	0.59
8	0.20
9	0.55
10	0.47
11	0.55
12	0.44
13	0.57
14	0.23
15	0.30
16	0.45
17	0.19
18	3.55
19	3.84
20	3.45
Average, nS	1.1
Limit, nS	2.0
Result	PASS

• Data for detector drift

20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
5.4	16.2	20.0	PASS



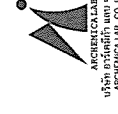
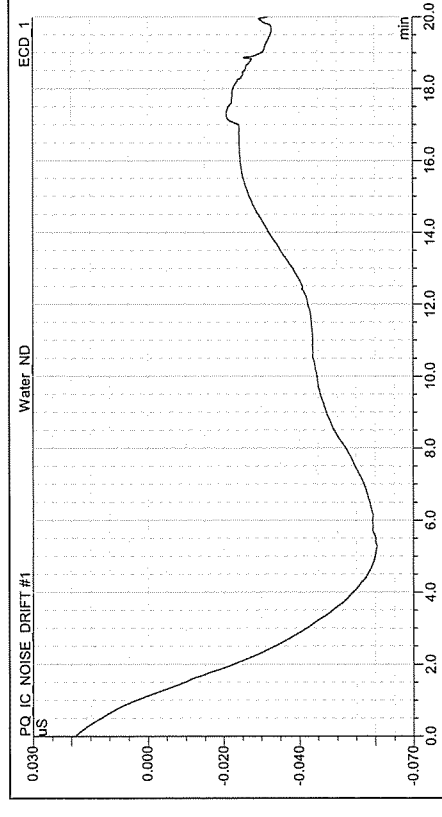
Nutdatai 30-3-23

Customer Signature Date

Chromeleon (c) DIONEX 2006
Version 6.80 SR8 Build 2623 (156243)

OQ_PQ_Integrated_Validation / Detector Noise and Drift
Printed: 30/3/2023 1:23 PM

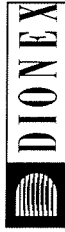
• Chromatogram of Detector Noise and Drift



Nutdatai 30-3-23

Customer Signature Date

OQ_PQ_Integrated_Validation / Detector Noise and Drift
Printed: 30/3/2023 1:23 PM



Performance Qualification Rev. 6.10

Injector Precision:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0

• Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Sample 4	Nitrate, 50 ppm	220701
Eluent	Water	n.a.

• Additional Information

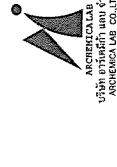
Customer/Company:	Khun.Ketsarin / Thai Environmental Technic Co.,Ltd	Date:	30-Mar-2023
Qualification Executor/Company:	Mr. Nutdanai / Archemica	Next Qualification:	Sep-2023

• Test Results Summary

Test	Result
Injector Precision (Area %RSD)	PASS

Customer Signature
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Customer Signature
Nutdanai
Date
30-3-23
OQ_PQ_Integrated_Validation / Injector Precision
Printed: 30/3/2023 1:23 PM



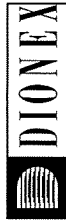
• Data for Injector Precision test

Name	Area
Inj Precision_1	uS*min Nitrate ECD_1 3.148
Inj Precision_2	3.199
Inj Precision_3	3.210
Inj Precision_4	3.200
Inj Precision_5	3.209
Inj Precision_6	3.237
Inj Precision_7	3.221
Inj Precision_8	3.208
Inj Precision_9	3.202
Inj Precision_10	3.202
Average:	3.204
Std. Dev:	0.023
% RSD:	0.7
Limit (%)	1.0
Result:	PASS

Customer Signature
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Customer Signature
Nutdanai
Date
30-3-23
OQ_PQ_Integrated_Validation / Injector Precision
Printed: 30/3/2023 1:23 PM





Performance Qualification Rev. 6.10

Injector Carryover:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

• Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (51'2")	n.a.
Sample 6	Nitrate, 1000 ppm	220701
Blank	Water	n.a.
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin / Thal Environmental Technic Co.,Ltd	Date:	30-Mar-2023
Qualification Executor/Company:	Mr. Nutdanai / Arche mica	Next Qualification:	Sep-2023

• Test Results Summary

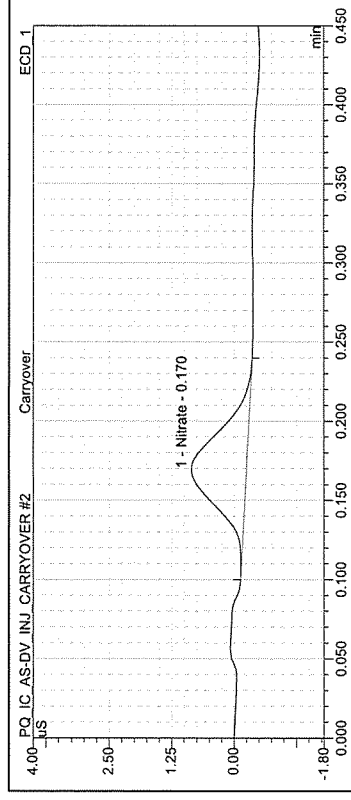
Test	Result
Injector Carryover (Area %)	PASS

Customer Signature _____ Date _____
Chromeleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

ARCHCHEMICAL LAB
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ARCHEMICAL LAB CO.,LTD.
Nutdanai 30-3-23
Date _____

Executor Signature _____
OQ_PQ Integrated Validation / Injector Carryover
Printed: 30/3/2023 1:23 PM

• Chromatogram for Carryover test



• Data for Carryover test

Name	Ret. Time (detected) min Nitrate ECD_1	Area uS*min Nitrate ECD_1
High Level	0.17	63.377
Carryover	0.17	0.057
Water	0.18	0.137
Carryover (%):		Not Detected
Limit (%):		0.100
Result:		PASS

Customer Signature _____ Date _____
Chromeleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

ARCHCHEMICAL LAB
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ARCHEMICAL LAB CO.,LTD.
Nutdanai 30-3-23
Date _____

Executor Signature _____
OQ_PQ Integrated Validation / Injector Carryover
Printed: 30/3/2023 1:23 PM



Performance Qualification Rev. 6.10

Detector Linearity:

• Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

• Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Sample 1	Nitrate, 5 ppm	220701
Sample 2	Nitrate, 10 ppm	220701
Sample 3	Nitrate, 25 ppm	220701
Sample 4	Nitrate, 50 ppm	220701
Sample 5	Nitrate, 100 ppm	220701
Eluent	Water	n.a.

• Additional Information

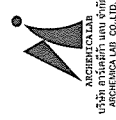
Customer/Company:	Khun.Ketsarin / Thai Environmental Technic Co.,L	Date:	30-Mar-2023
Qualification	Mr. Nutdanai / Archemica	Next Qualification:	Sep-2023

• Test Results Summary

Test	Result
ICS-1100 Detector Linearity (Corr.)	PASS
ICS-1100 Detector Linearity (%RSD)	PASS

Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

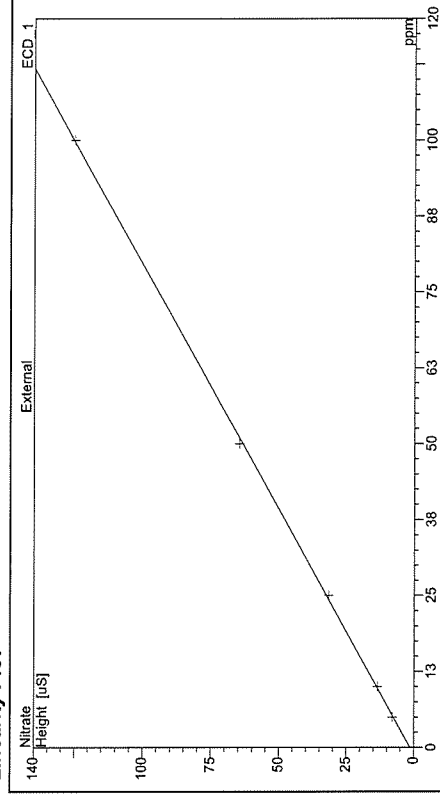


Nutdanai 30-3-23

• Data for Detector Linearity

Name	Amount ppm Nitrate ECD_1	Height uS Nitrate ECD_1
Detector linearity_1	5.000	7.936
Detector linearity_2	10.000	13.479
Detector linearity_3	25.000	31.576
Detector linearity_4	50.000	64.733
Detector linearity_5	100.000	124.951

• Linearity Plot



Calibration Type	Number of Points	Offset	Slope
LOff	5	1.435	1.239

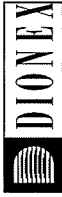
Linearity:	Correlation Coefficient	% RSD
Limit:	1.000	2.0
Result:	0.999	5.0
	PASS	PASS

Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

Customer Signature _____ Date _____
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)



Nutdanai 30-3-23



Performance Qualification Rev. 6.10

Pump Flow Rate Accuracy and Precision Test:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0

• Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Eluent	Water	n.a.
Balance	AB 204	Mettler Toledo 1116392227

• Additional Information

Customer/Company:	Khun.Ketsarin / Thai Environmental Technic Co.,	Date:	30-Mar-2023
Qualification Executor/Company:	Mr. Nutdanai / Archemica	Next Qualification:	Sep-2023

• Test Results Summary

Test	Result
ICS-1100 Pump Flow Rate Accuracy (mL/min)	PASS
ICS-1100 Pump Flow Rate Precision (%RSD)	PASS

Customer Signature Date
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

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ARCHEMICA LAB CO.,LTD.
Nutdanai 30-3-23
Executor Signature Date

OO_PQ_Integrated_Validation / Pump Flow Rate
Printed: 30/3/2023 1:23 PM

• Data for Pump Flow Rate Accuracy and Precision Test

Ambient Temperature (°C)	25
--------------------------	----

Segment	Measured Eluent Weight (g)	Calculated Eluent Flow Rate (mL/min)	Deviation from 1.00 mL/min	Limit (mL/min)	Result
0	116.822	-	-	-	-
1	121.665	0.971	0.029	0.05	PASS
2	126.559	0.982	0.018	0.05	PASS
3	131.426	0.976	0.024	0.05	PASS
4	136.279	0.973	0.027	0.05	PASS
5	141.140	0.975	0.025	0.05	PASS
Average		0.976		Overall	PASS

Standard Deviation	0.004
% RSD	0.4
Limit (%)	2.0
Result	PASS

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ARCHEMICA LAB CO.,LTD.
Nutdanai 30-3-23
Executor Signature Date

Customer Signature Date
Chromleon (c) DIONEX 2011
Version 6.80 SR8 Build 2623 (156243)

OO_PQ_Integrated_Validation / Pump Flow Rate
Printed: 30/3/2023 1:23 PM

Certificate

Certificate of Standards and Instruments for Qualification

Certificate of Analysis

Better Separations Through
Better Chemistry

Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254
Certificate of Analysis

Lot Number 220701

Expiration of Certification
July 2023

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in ≥ 18.2 megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	5.02 \pm 0.02
2	9.86 \pm 0.05
3	25.02 \pm 0.11
4	50.54 \pm 0.29
5	100.0 \pm 1
6	1014 \pm 5



The concentration value is based a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078690-01 20-Dec-2011

thermoscientific.com/dionex
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Thermo Fisher Scientific
1720 Tilden Way
P.O. Box 3003
Sunnyvale, CA 94088-3003
(408) 737-0700



thermo
scientific

Certificate of Completion

This certifies that

Nutdanai Laekhwan

Has successfully completed

**IC Installation, Maintenance and Troubleshooting Service
Training**

Valid Certificate no expire date:

Sep/28/2022

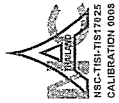


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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLIANG SUANLIANG BANGKOK 10250
TEL 0-2717-3000-27 FAX 0-2719-9484



Cert.No.: 22CHO625
Page.: 1 of 3

Certificate of Calibration

Equipment : Spectrophotometer
Manufacturer : PerkinElmer
Model : Lambda 365
Serial No. : 365K9042909
ID No. :
Condition As-Received:
Received Date : 01 November 2022
Calibration Date : 01 November 2022
Reference : 2211-0001OC-5
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240

Calibration Place : Laboratory (Thai Environment Technic Limited)
Ambient Temperature : (24.9 - 24.4) °C (On-Site)
Relative Humidity : (54 - 52) % (On-Site)
Calibration Procedure : In - house method :
CP-0CH4 based on ASTM E 275-01

Calibrated by : Uthen Kankawi

Approved by :
Approved Signatory

() Malee Butkruea
() Sathip Meangmai
() Warakorn Lerngatrakul

Issue Date : 10 November 2022
The Uncertainties are for a confidence probability of approximately 95 %

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0047052



Cert. No. : 22CHO625
Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	39130	106269	10 Oct 2024
2. Wavelength Standard set	29829	94776	02 Sep 2023
3. Wavelength Standard set	29829	94777	02 Sep 2023
4. Stray Light Standard set	32629	9112980	03 Aug 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit maintained at :

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral Bandwidth : 1 nm

Scan Speed : 30 nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (± nm)	Coverage Factor k
418.53	418.32	0.12	2.00
536.52	536.61	0.12	2.00
638.00	637.96	0.12	2.00
684.50	684.48	0.12	2.00
879.41	879.39	0.12	2.00

a 1134411



Cert. No.: 22CHO625

Page: 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (±Abs)	Coverage Factor k
420.0	Zero	0.0000	0.0028	2.00
	0.5796	0.5788	0.0028	2.00
	0.7105	0.7095	0.0028	2.00
	1.0186	1.0179	0.0028	2.00
546.1	Zero	0.0000	0.0028	2.00
	0.5281	0.5258	0.0028	2.00
	0.6962	0.6945	0.0028	2.00
	0.9984	0.9956	0.0028	2.00
635.0	Zero	0.0000	0.0028	2.00
	0.5699	0.5684	0.0028	2.00
	0.7606	0.7590	0.0028	2.00
	1.0927	1.0904	0.0028	2.00

Stray Light

* Straylight at 280.05 nm ± 0.11 nm	Reading at 280.05 nm ± 0.11 nm
Abs	2.0728
%T	0.8299

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- Cut-off wavelength of stray light reference material (Potassium Iodide) at wavelength 280.05 nm ± 0.11 nm
- Result = Pass, If Absorbance > 2.00 Abs and Transmission < 1.0 %T at Wavelength 280.05 nm ± 0.11 nm
- * : Not NSC-ONSC Accredited

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

-o0o-

Walu

a 1134410



SCARLETT 113

CERTIFICATE OF CALIBRATION

NO. 20221215058

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820390
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14

Calibrated by: *Jim Lin*

- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlett Tech Co Ltd Taiwan.

1. Preliminary Inspection: OK

2. Type & serial No. of Microphone: AWA14425-5A/B25

3. Adjustments to indicated sound levels:

Type of Calibrator: B&K 4231

Sound Pressure Level: 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

4. Measuring up limit: 140 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
315	-39.4	-2.2	0.1	4000	1.3	-0.1	0.0
63	-26.2	-0.8	-0.1	8000	1.1	-0.8	0.0
125	-16.3	-0.1	-0.1	12500	-5.6	-7.2	0.1
250	-8.6	0.1	0.0	16000	-11.6	-13.6	0.2
500	-3.1	0.1	0.1	20000	-23.5	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

6.9 dB(A)	7.0 dB(C)	15.1 dB(Z)
-----------	-----------	------------

7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.0
Rate of the S weighting decrease (dB/s)	4.4
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level -0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	$L_{1max}-L_A$	$L_{1max}-L_A$	$L_{1F}-L_A$	$L_{1F}-L_A$
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.2	-26.9	-26.9	-7.0
10	-27.2	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.4	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB

Sweep amplitude: 40 dB

Scan cycle time: 40. S; Measurement period: 180. S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0

L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20. °C
Relative humidity: 60. %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

- All Scarlett's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphones which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



SCARLETT, S.P.



CERTIFICATE OF CALIBRATION

NO. 20221215059

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820391
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14

Calibrated by:

Jim Lin

- i. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpasses then, and applies only to the unit identified above.
- ii. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- iii. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlett Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-54662

4. Measuring up limit: 140 dBA

3. Adjustments to indicated sound levels:

Type of Calibrator, B&K 4231

Sound Pressure Level 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
315	-39.4	-2.1	0.1	4000	1.2	-0.1	0.0
63	-26.1	-0.7	-0.1	8000	1.2	-0.8	0.0
125	-16.3	-0.1	-0.1	12500	-5.6	-7.1	0.1
250	-8.6	0.1	0.0	16000	-11.6	-13.6	0.2
500	-3.1	0.1	0.1	20000	-23.5	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

8.4 dB(A)	8.2 dB(C)	13.4 dB(Z)
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7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.4
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level -0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	L _{max} -L _s	L _{max} -L _s	L _{max} -L _s	L _{max} -L _s
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.1	-26.9	-26.9	-7.0
10	-27.2	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.4	3.5	2.4	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0

L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 60 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

- All Scarlett's Sound Level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMP000-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



CERTIFICATE OF CALIBRATION

NO. 20221215060

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820392
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14

Calibrated by: Jim Lin

- This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Standards or respectively surpass them, and applies only to the unit identified above.
- This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlett Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-52235

4. Measuring up limit: 140 dBA

3. Adjustments to indicated sound levels:

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Type of Calibrator: B&K 4231

Sound Pressure Level: 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions): 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
315	-39.4	-2.1	0.1	4000	1.2	-0.1	0.0
63	-26.1	-0.7	-0.1	8000	1.2	-0.8	0.0
125	-16.4	-0.1	-0.1	12500	-5.6	-7.2	0.1
250	-8.6	0.1	0.0	16000	-11.5	-13.3	0.2
500	-3.1	0.1	0.1	20000	-23.4	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

10.5 dB(A)	9.5 dB(C)	16.1 dB(Z)
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7. F&S Weighting

Rate of the F-weighting decrease (dB/s)	35.2
Rate of the S-weighting decrease (dB/s)	4.3
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB
Max error at 10dB steps upper reference sound level -0.1 dB
Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB
Max error at 10dB steps below reference sound level 0.1 dB
Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	L _{lower} -L _u	L _{lower} -L _u	L _u -L _u	L _u -L _u
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.1	-26.9	-26.9	-7.0
10	-27.3	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.4	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB
Sweep amplitude: 40 dB
Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0

L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 60 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 340	33873	2024-10-15	CEPREI

Test specifications:

- All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests

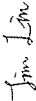


SCARLETT

CERTIFICATE OF CALIBRATION

NO. 20221215061

Name of Product:	Sound Level Meter
Model:	ST-110
Serial Number:	820393
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14

Calibrated by: 

- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manuals or respectively surplus then, and applies only to the unit identified above.
II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlett Tech Co Ltd Taiwan.

1. Preliminary inspection: OK
2. Type & serial No. of Microphone: AWA14425-52714
3. Adjustments to indicated sound levels:
Type of Calibrator: B&K 4231
Sound Pressure Level: 94.0 dB
4. Measuring up limit: 160 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests,)

Nominal frequency /Hz	Frequency weighting /dB			Nominal frequency /Hz	Frequency weighting /dB		
	A	C	Z		A	C	Z
10	-71.1	-14.4	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
31.5	-39.4	-2.1	0.1	4000	1.2	-0.1	0.0
63	-26.1	-0.4	-0.1	8000	1.2	-0.8	0.0
125	-16.4	-0.1	-0.1	12500	-5.2	-7.2	0.1
250	-8.6	0.1	0.0	16000	-11.5	-13.3	0.2
500	-3.1	0.1	0.1	20000	-23.4	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

7.7 dB(A)	8.4 dB(C)	13.9 dB(Z)
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7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.2
Rate of the S weighting decrease (dB/s)	4.2
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB
Max error at 10dB steps upper reference sound level -0.1 dB
Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB
Max error at 10dB steps below reference sound level 0.1 dB
Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	L _{max} -L _a	L _{max} -L _a	L _a -L _a	L _a -L _a
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.0	-26.9	-26.9	-7.0
10	-27.2	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.4	3.5	2.4	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB
Sweep amplitude: 40 dB
Scan cycle time: 60 S; Measurement period: 180 S;

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{Aeq,T}	103.2	103.2	0.0

L5	110.8	110.8	110.8	0.0
L10	108.8	108.8	108.8	0.0
L50	92.9	92.9	92.8	0.1
L90	76.9	76.9	76.8	0.1
L95	75.0	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 60 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGIS/MEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

- All Scarlett's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMP001-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±0.0%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



SCARLETT TECHNOLOGY



CERTIFICATE OF CALIBRATION

NO. 20221215062

Name of Product:	Sound Level Meter
Model:	ST-110
Serial Number:	820394
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14

Calibrated by: Jim Lin

- This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them, and applies only to the unit identified above.
- This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlett Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-52756

4. Measuring up limit: 140 dBA

3. Adjustments to indicated sound levels:

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.4	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
315	-39.4	-2.2	0.1	4000	1.2	-0.1	0.0
63	-28.1	-0.3	-0.1	8000	1.2	-0.9	0.0
125	-16.1	-0.1	-0.1	12500	-5.2	-7.2	0.1
250	-8.5	0.1	0.0	16000	-11.5	-13.4	0.2
500	-3.2	0.1	0.1	20000	-23.4	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

10.8 dB(A)	10.3 dB(C)	15.8 dB(Z)
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7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.1
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB
Max error at 10dB steps upper reference sound level -0.1 dB
Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB
Max error at 10dB steps below reference sound level 0.1 dB
Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	L _{max} -L _A	L _{mean} -L _A	L _A -L _A	L _{ref} -L _A
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.0	-26.9	-26.9	-7.0
10	-27.1	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.4	3.5	2.4	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB
Sweep amplitude: 40 dB
Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0

L5	110.8	110.8	110.8	0.0
L10	108.8	108.8	108.8	0.0
L50	92.9		92.8	0.1
L90	76.9		76.8	0.1
L95	75.0		74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 60 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2979405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2788444	2024-10-15	CIGISEC
Signal generator	DS 340	33873	2024-10-15	CEPREI

Test specifications:

- All Scirel's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMP004-CA-15Z.
- The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of $\pm 20\%$.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



CERTIFICATE OF CALIBRATION

NO. 20230113117

Name of Product: Sound Level Meter
Model: ST-11D
Serial Number: F20877
Specification: Class 1
Conclusion: Pass
Date of calibration: 2023-02-01
Due Date: 2024-01-31



Calibrated by: Jim Lin

- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manuals or respectively surplus them, and applies only to the unit identified above.
- II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein
- III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlett Tech Co., Ltd Taiwan.

- 1. Preliminary inspection: OK
- 2. Type & serial No. of Microphone: AWA14425-5/237
- 3. Adjustments to indicated sound levels: Type of Calibrator: B&K 4231
- 4. Measuring up limit: 130 dBA
- 5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests:)

Sound Pressure Level 94.0 dB
Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency / Hz	Frequency weighting / dB			Nominal frequency / Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.2	-0.3	1000	0.0	0.0	-0.1
20	-50.1	-6.3	-0.1	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.7	-0.1	4000	1.1	-0.8	-0.1
63	-26.2	-0.5	-0.1	8000	-1.0	-3.1	0.0
125	-16.2	-0.2	0.0	12500	-11.7	-13.7	0.0
250	-8.6	0.1	-0.1	16000	-11.6	-13.6	0.1
500	-3.2	0.0	-0.1	20000	-23.8	-25.9	-0.1

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0
L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.2 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 50 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NNL
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGSMEC
Signal generator	DS 800	33873	2024-10-15	CEPREI

Test specifications:

- 1. All Scarlett's Sound Level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMT-P004-Ca-152.
- 2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- 3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



CERTIFICATE OF CALIBRATION

NO. 202301131118

Name of Product: Sound Level Meter
Model: ST-11D
Serial Number: 870878
Specification: Class 1
Conclusion: Pass
Date of calibration: 2023-02-01
Due Date: 2024-01-31



Calibrated by: Jim Lin

- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manuals or respectively surpass them, and applies only to the unit identified above.
II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co. Ltd Taiwan

1. Preliminary inspection: OK
2. Type & serial No. of Microphone: AWA142-5553D
3. Adjustments to indicated sound levels: Type of Calibrator: B&K 4231
4. Measuring up limit: 140 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests):

Sound Pressure Level 94.0 dB
Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency / Hz	Frequency weighting / dB			Nominal frequency / Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.2	-14.3	-0.4	1000	0.0	0.0	-0.1
20	-50.1	-6.3	-0.2	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.7	-0.1	4000	1.1	-0.8	-0.1
63	-26.2	-0.5	-0.1	8000	-1.0	-3.1	0.0
125	-16.2	-0.1	0.0	12500	-11.7	-13.7	0.0
250	-8.6	0.2	-0.1	16000	-11.5	-13.6	0.1
500	-3.2	0.0	-0.1	20000	-23.8	-25.8	-0.1

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{eq,T}	103.2	103.2	0.0
L ₅	110.8	110.8	0.0
L ₁₀	108.8	108.8	0.0
L ₅₀	92.9	92.8	0.1
L ₉₀	76.9	76.8	0.1
L ₉₅	75.0	74.9	0.1

Uncertainty of measurement results: 0.2 dB (k=2)

Environment conditions:
Air temperature: 20. °C
Relative humidity: 50. %
Static pressure: 101.8. kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2529405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGSMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

1. All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMT-P004-CK-152.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an electrical signal source of 2400 ohms.
3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



CERTIFICATE OF CALIBRATION

NO. 20230113119

Name of Product: Sound Level Meter
Model: ST-J110
Serial Number: 8708296
Specification: Class 1
Conclusion: Pass
Date of calibration: 2023-02-01
Due Date: 2024-01-31

Calibrated by: *Jm Lin*



I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manuals or respectively surpass them, and applies only to the unit identified above.
II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK
2. Type & serial No. of Microphone: ANA14435-16240
3. Adjustments to indicated sound levels:
Type of Calibrator: 88K 4226
Sound Pressure Level: 94.0 dB
4. Measuring up limits: 140 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.2	-14.3	-0.3	1000	0.0	0.0	-0.1
20	-50.2	-6.3	-0.1	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.7	-0.1	4000	1.1	-0.8	-0.1
63	-26.2	-0.4	-0.1	8000	-1.0	-3.1	0.0
125	-16.2	-0.1	0.0	12500	-11.7	-13.7	0.0
250	-8.6	0.1	-0.1	16000	-11.5	-13.6	0.1
500	-3.2	0.0	-0.1	20000	-23.8	-25.9	-0.1

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0
LS	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.1 dB (k=2)

Environment conditions:
Air temperature: 20. °C
Relative humidity: 50. %
Static pressure: 101.8. kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	88K 4191	2939405	2024-12-15	NML
Multi function sound calibrator	88K 4226	2388444	2024-10-15	CIGSMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:
1. All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMTPO04-CA-163.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ± 0.05%.
3. The acoustic calibration was performed using an 88K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:
IEC 61672-3 Sound Level Meters Part 3: Periodic tests

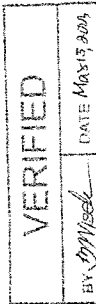
Certificate of Calibration

Customer
Name : SGS (Thailand) Limited.
Address : 100 Nanglinchee Road, Chongnonsi, Yamsua Bangkok 10120
Certificate No : 23-SLM-086
Request No : Req-2023-0575

Unit Under Calibration Details
Measurement Item : Sound Level Meter
Manufacturer : Cirrus
Model : CR171B
Serial Number : G078141
ID : ENSL 16125
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 7 March 2023
Calibrated Date : 13 March 2023
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61072-3 : 2013 Electroacoustics • Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard
Instrument : Brand : Model : SN : Due calibration : Traceability
Standard Microphone : GRAS : 40AN : 188273 : 6 October 2023 : GRAS
Multifrequency Calibrator : Quest : Quest-eal : EPA000234 : 29 June 2023 : TSI
Audio Generator : Svanick : Svan401 : 131 : 12 October 2023 : WK Electric
Note
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : ppc Approved By : Mr. Paet Mahaxom
Mr. Noppadon Luangrat Calibration Engineer Supervisor
Calibration Officer Issue Date : 13 March 2023



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PAC-708-SLM-01 Rev.01 Issued date: 01/07/19

Certificate No : 23-SLM-086
Request No : Req-2023-0575

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
PAST / A / 20-140							
Calibrator Setting							
1000 Hz 94.00 dB	94.03	90.3	-3.73	93.8	-0.23	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Cirrus, Model CR2515, SN: 80400

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140		
UUC Weighting	(dB)	(± dB)
A	16.5	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140		
UUC Weighting	(dB)	(± dB)
A	-	0.10
C	16.4	0.10
Z	34.2	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 20-140					
STD Setting	(dB)	(dB)	(dB)	(± dB)	
125 Hz	0.6	0.4	0.3	0.50	1.0
1000 Hz	0.0	0.0	0.0	0.60	0.7
4000 Hz	-0.7	-0.7	-0.7	0.60	1.0
8000 Hz	-0.5	-0.4	-0.1	0.70	+1.5 -2.5

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd
PAC-708-SLM-01 Rev.01 Issued date: 01/07/19



Certificate No : 23-SLM-086
Request No : Req-2023-0575

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST: 20-140	Weighting Response curve				
		STD Setting	A (dB)	C (dB)		
65 Hz		0.2	0.0	0.1		1.0
125 Hz		0.1	0.0	0.1		1.0
250 Hz		0.1	0.0	0.1		1.0
500 Hz		0.1	0.0	0.0		1.0
1000 Hz		0.0	0.0	0.0	0.2	0.7
2000 Hz		-0.1	0.0	0.0		1.0
4000 Hz		-0.2	-0.2	0.0		1.0
8000 Hz		-0.2	-0.2	-0.1		+1.5, -2.5
16000 Hz		0.2	0.2	-0.1		+2.5, -16.0

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
		(dB)	(dB)		
FAST / 20-140					
UUC Weighting					
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
		(dB)	(dB)		
20-140 / A					
UUC Time Response					
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0		0.1

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PN-706-SLM-086 Rev.0 Issue date 01 07 19



Certificate No : 23-SLM-086
Request No : Req-2023-0575

7. Long Term Stability

UUC Setting	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	FAST / A / 20-140	UUC (dB)		
STD Setting				
Initial		114.0		
Final		114.0		
Deviated		0.0	0.1	0.1

8. Level linearity on the reference level range

UUC Setting	Anticipated		Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	REF (dB)	UUC (dB)	ERR (dB)	ERR (dB)		
FAST / A / 20-140						
STD dB						
139.00	139	139.0	0.0			0.8
134.00	134	134.0	0.0			0.8
129.00	129	129.0	0.0			0.8
124.00	124	124.0	0.0			0.8
119.00	119	119.0	0.0			0.8
114.00	114	114.0	0.0			0.8
109.00	109	109.0	0.0			0.8
104.00	104	104.0	0.0			0.8
99.00	99	99.0	0.0			0.8
94.00	94	94.0	0.0			0.8
89.00	89	89.0	0.0			0.8
84.00	84	84.0	0.0			0.8
79.00	79	79.0	0.0		0.3	0.8
74.00	74	74.0	0.0			0.8
69.00	69	69.0	0.0			0.8
64.00	64	64.0	0.0			0.8
59.00	59	59.0	0.0			0.8
54.00	54	54.0	0.0			0.8
49.00	49	49.0	0.0			0.8
44.00	44	44.1	0.1			0.8
39.00	39	39.1	0.1			0.8
34.00	34	34.1	0.1			0.8
29.00	29	29.1	0.1			0.8
24.00	24	24.2	0.2			0.8

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd
PN-706-SLM-086 Rev.0 Issue date 01 07 19

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
129 MOO 18, SOI SINDHAKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHLI SAH 1 PRAKAN PREVINEE 10440 THAILAND
TEL : 06-92116-5800 FAX: 06-92116-140



Certificate of Calibration

Customer
Name : SGS (Thailand) Limited,
Address : 100 Manginthee Road, Chongnonsi, Yarnawa Bangkok 10120
Certificate No : 23-SLM-041
Request No : Req-2023-0295

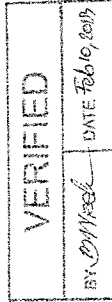
Unit Under Calibration Details
Measurement Item : Sound Level Meter
Manufacturer : Cirrus
Model : CR161B
Serial Number : G078054
ID : ENSI 16122
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50% RH ± 20% RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 2 February 2023
Calibrated Date : 9 February 2023
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic
Reference Standard : Lab Acoustic

Microphone Class : 1
Microphone Model : MK224
Microphone S/N : 206565A
Preamplifier Model : KM1170
Preamplifier S/N : 0824
Instrument Status : Used

Instrument	Brand	Model	S/N	Date calibration	Traceability
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	29 June 2023	ISI
Audio Generator	Stank	Sym-401	131	12 October 2023	WK Electric

Note
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : Dr. Noppadon Luang
Approved By : Mr. Paeit Mahaveon
Calibration Officer
Calibration Engineer Supervisor
Issue Date : 9 February 2023



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PNI-708-SLM-01 Rev.0 Issue date 01/07/19

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
129 MOO 18, SOI SINDHAKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHLI SAH 1 PRAKAN PREVINEE 10440 THAILAND
TEL : 06-92116-5800 FAX: 06-92116-140



Certificate No : 23-SLM-041
Request No : Req-2023-0295

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust	Adjust	UNCERTAINTY	Acceptance Limit
FAST / A / 20-140	(dB)	UUC (dB)	ERR (dB)	UUC (dB)	(± dB)
Calibrator Setting					
1000 Hz 94.00 dB	93.81	93.7	-0.11	93.8	0.20
				-0.01	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, S/N. 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140	(dB)	(± dB)
UUC Weighting		
A	19.7	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140	(dB)	(± dB)
UUC Weighting		
A	-	0.10
C	18.2	0.10
Z	31.1	0.10

4. Acoustic signal test of frequency weightings (Without Windscreens)

UUC Setting	Deviation From Various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit
FAST / 20-140	A C Z	(dB)	(± dB)
STD Setting			
125 Hz	0.5	0.3	0.2
1000 Hz	0.0	0.0	0.0
4000 Hz	-0.8	-0.7	-0.3
8000 Hz	0.2	0.5	0.9
			+1.5 -2.5

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PNI-708-SLM-01 Rev.0 Issue date 01/07/19



Certificate No : 21-SI-M-041
Request No : Req-2023-0295

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Weighting Response curve					
FAST /20-140	STD Setting	A (dB)	C (dB)	Z (dB)		
	63 Hz	0.2	0.0	0.0	0.2	1.0
	125 Hz	0.2	0.0	0.0		1.0
	250 Hz	0.2	0.0	0.0		1.0
	500 Hz	0.1	0.0	0.0		1.0
	1000 Hz	0.0	0.0	0.0		0.7
	2000 Hz	-0.2	0.0	0.0		1.0
	4000 Hz	-0.4	-0.2	0.0		1.0
	8000 Hz	-0.5	-0.4	-0.1		+1.5,-2.5
	16000 Hz	0.1	0.2	-0.3		+2.5,-16.0

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)	
FAST / 20-140				
UUC Weighting	A	114.00	0.0	0.2
	C	114.00	0.0	0.2
	Z	114.00	0.0	0.2

UUC Setting	STD REF	Measured		Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)	
20-140 / A				
UUC Time Response	Fast	114.00	0.0	0.1
	Slow	114.00	0.0	0.1
	Leq	114.00	0.0	0.1

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FIS-706-SLM-01 Rev.0 Issue date 01/07/19



Certificate No : 21-SLM-041
Request No : Req-2023-0295

7. Long Term Stability

UUC Setting	Measured UUC (dB)	Acceptance Limit (\pm dB)
FAST / A 20-140		
STD Setting	Initial	114.0
	Final	114.0
	Deviated	0.0
		0.1
		0.1

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)	
FAST / A 20-140				
STD dB	139.00	139	139.0	0.0
	134.00	134	134.0	0.0
	129.00	129	129.0	0.0
	124.00	124	124.0	0.0
	119.00	119	119.0	0.0
	114.00	114	114.0	0.0
	109.00	109	109.0	0.0
	104.00	104	104.0	0.0
	99.00	99	99.0	0.0
	94.00	94	94.0	0.0
	89.00	89	89.0	0.0
	84.00	84	84.0	0.0
	79.00	79	79.0	0.0
	74.00	74	74.0	0.0
	69.00	69	69.0	0.0
	64.00	64	64.0	0.0
	59.00	59	59.0	0.0
	54.00	54	54.0	0.0
	49.00	49	49.0	0.0
	44.00	44	44.0	0.0
	39.00	39	39.0	0.0
	34.00	34	34.0	0.0
	29.00	29	29.1	0.1
	24.00	24	23.9	-0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FIS-706-SLM-01 Rev.0 Issue date 01/07/19



Certificate No : 23-SLM-041
Request No : Req-2023-0295

9. Level linearity including the level range control!

DUC Setting	Measured			UNCERTAINTY (\pm dB)	Acceptance Limit
	STD	UUC	ERR		
	REF	(dB)	(dB)		
FAST-A					0.8
UUC Range					0.8
20:140	25.3	25.4	0.1	0.3	
	114	114.6	0.0		

10. Tone burst response

UUC Setting		STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
				UUC (dB)	ERR (dB)		
Fast	A ₁ : 20-40 UUC Time Response	200	136.0	136.0	0.0		0.5
		2	119.0	118.9	-0.1		± 1.0 , -1.5
		0.25	110.0	109.9	-0.1		± 1.0 , -2.0
							0.5
Slow		200	129.6	129.6	0.0	0.3	± 1.0 , -3.0
		2	110.0	110.0	0.0		0.5
		200	130.0	130.0	0.0		± 1.0 , -1.5
		2	110.0	110.0	0.0		± 1.0 , -2.0
SEL		0.25	101.0	101.0	0.0		

11. Peak C Sound level

UUC Setting FAST / C / 20-140	Anticipated		Measured		UNCERTAINTY (+/- dB)	Acceptance Limit (+/- dB)
	REF (dB)	UUC (dB)	ERR (dB)	UUC (dB)		
Complete cycle	135.4	135.6	+0.20		0.2	2.0
	134.4	134.2	-0.20			1.0
Negative half cycle	134.4	134.2	-0.20			1.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Inoperative Instrument Co., Ltd.



Certificate No : 23-SLM-041
Request No : Req-2023-0295

12. Overload indication

4.2. OVERALL INFORMATION	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	TUC Setting	TUC		
FAST / A 20-140		TUC (dB)		
STD Setting				
Positive one-half cycle		143.7		
Negative one-half cycle		143.6		
Deviated		0.1	0.2	1.5

13. High Level Stability

22. High level accuracy		Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
UUC Setting	UUC			
FAST / A / 20-140		139.0		
STD Setting				
Initial		139.0		
Final		139.0		
Deviated		0.0	0.1	0.1

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FNI-708-SLM-01 Rev.0

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CALIBRATION LTD HEAD OFFICE
719 MOO 13, SOI SUTASAKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHU ISAN 11 PRAKARN PRATUM 10640 THAILAND
TEL: 0609-216-5804 FAX: 0609-216-7140



Certificate of Calibration

Customer
Name : SGS (Thailand) Limited
Address : 100 Nanglinchee Road, Chongnonsi, Yamao Bangkok 10120
Certificate No : 23-SLM-041
Request No : Req-2023-0295

Unit Under Calibration Details
Measurement Item : Sound Level Meter
Manufacturer : Cirrus
Model : CR161B
Serial Number : G078084
ID : ENSL 16122
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 1 °C
Humidity : 50%RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 2 February 2023
Calibrated Date : 9 February 2023
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard
Instrument : Brand : Model : SN :
Standard Microphone : GRAS : 40AN : 188273 : Die calibration : 6 October 2023 : Traceability : GRAS
Multifrequency Calibrator : Quest : Quest-cal : EFA000234 : 29 June 2023 : TSI
Audio Generator : Sennheiser : Senn401 : 131 : 12 October 2023 : WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : PPC
Mr. Nopadol Luangrit
Calibration Officer

Approved By : PPC
Mr. Puri Mahaworn
Calibration Engineer Supervisor

Issue Date : 9 February 2023



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd
EN-706-SLM-01 Rev.01 Issue Date 01/07/19

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CALIBRATION LTD HEAD OFFICE
719 MOO 13, SOI SUTASAKORN 11 TAMBON BANG KAO,
AMPHOE BANG PHU ISAN 11 PRAKARN PRATUM 10640 THAILAND
TEL: 0609-216-5804 FAX: 0609-216-7140



Certificate No : 23-SLM-041
Request No : Req-2023-0295

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Level (dB)	UUC	ERR	UUC	ERR		
		(dB)	(dB)	(dB)	(dB)		
FAST / A, 20-140 Calibrator Setting	93.81						
1000 Hz 94.00 dB		93.7	-0.11	93.8	-0.01	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SYVANTEK, Model SV 35A, SN: 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	19.7	0.10

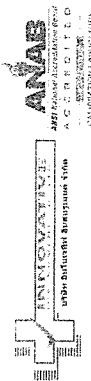
3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 20-140	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	-	0.10
C	18.2	0.10
Z	31.1	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

4. Acoustic signal test or frequency weightings	UUC Setting	Deviation from various Frequency Weighting Response curve				UNCERTAINTY	Acceptance Limit
		A			Z		
		(dB)	C	(dB)			
	FAST / 20-140						
	STD Setting						
	125 Hz	0.5	0.3	0.2	0.50	1.0	
	1000 Hz	0.0	0.0	0.0	0.60	0.7	
	4000 Hz	-0.8	-0.7	-0.3	0.60	1.0	
	8000 Hz	0.2	0.5	0.9	0.70	+1.5 -2.5	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd
EN-706-SLM-01 Rev.01 Issue Date 01/07/19



Certificate No : 23-SLM-041
Request No : Req-2023-0295

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting		Deviation from various Frequency			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
FAST / 20-140	STD Setting	A (dB)	C (dB)	Z (dB)		
	63 Hz	0.2	0.0	0.0	0.2	1.0
	125 Hz	0.2	0.0	0.0		1.0
	250 Hz	0.2	0.0	0.0		1.0
	500 Hz	0.1	0.0	0.0		1.0
	1000 Hz	0.0	0.0	0.0		0.7
	2000 Hz	-0.2	0.0	0.0		1.0
	4000 Hz	-0.4	-0.2	0.0		1.0
	8000 Hz	-0.5	-0.4	-0.1		+1.5, -2.5
	16000 Hz	0.1	0.2	-0.3		+2.5, -16.0

6. Frequency and time weightings at 1kHz

	UUC Setting	Measured				UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		STD	UUC				
			REF	(dB)	ERR		
UUC Weighting	A	114.00	114.0	0.0	0.2	0.2	
	C	114.00	114.0	0.0		0.2	
	Z	114.00	114.0	0.0		0.2	

UUC Setting	Measured				UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
	STD REF (dB)	UUC (dB)		ERR (dB)		
		UUC Time Response				
20-140 / A	114.00	114.0	0.0	0.0	0.2	0.1
Fast	114.00	114.0	0.0	0.0		0.1
Slow	114.00	114.0	0.0	0.0		0.1
Leq	114.00	114.0	0.0	0.0		0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-208-SLM-01 Rev.0 Issue date 01/07/19



Certificate No : 23-SLM-041
Request No : Req-2023-0295

7. Long Term Stability

UUC Setting FAST / A / 20-140	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	UUC	(dB)		
STD Setting	Initial	114.0		
	Final	114.0		
Deviated		0.0	0.1	0.1

8. Level linearity on the reference level range

UUC Setting FAST / A / 20-140	STD dB	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
			UUC (dB)	ERR (dB)		
	139.00	129	139.0	0.0		0.8
	134.00	124	134.0	0.0		0.8
	129.00	129	129.0	0.0		0.8
	124.00	124	124.0	0.0		0.8
	119.00	119	119.0	0.0		0.8
	114.00	114	114.0	0.0		0.8
	109.00	109	109.0	0.0		0.8
	104.00	104	104.0	0.0		0.8
	99.00	99	99.0	0.0		0.8
	94.00	94	94.0	0.0		0.8
	89.00	89	89.0	0.0		0.8
	84.00	84	84.0	0.0		0.8
	79.00	79	79.0	0.0	0.3	0.8
	74.00	74	74.0	0.0		0.8
	69.00	69	69.0	0.0		0.8
	64.00	64	64.0	0.0		0.8
	59.00	59	59.0	0.0		0.8
	54.00	54	54.0	0.0		0.8
	49.00	49	49.0	0.0		0.8
	44.00	44	44.0	0.0		0.8
	39.00	39	39.0	0.0		0.8
	34.00	34	34.0	0.0		0.8
	29.00	29	29.1	0.1		0.8
	24.00	24	23.9	-0.1		0.8

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-208-SLM-01 Rev.0 Issue date 01/07/19



Certificate No : 23-SLM-041
Request No : Req-2023-0295

9. Level linearity including the level range control

UUC Setting FAST / A	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
20-140	25.3	25.4	0.1	0.3	0.8
	114	114.0	0.0		

10. Tone burst response

UUC Setting A / 20-140	STD Toneburst (ms)	Anticipated		Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		Ref (dB)		UUC (dB)	ERR (dB)		
Fast	200	136.0		136.0	0.0	0.3	0.5
	2	119.0		118.9	-0.1		
	0.25	110.0		109.9	-0.1		
Slow	200	129.6		129.6	0.0	0.3	0.5
	2	110.0		110.0	0.0		
	200	130.0		130.0	0.0		
SEL	2	110.0		110.0	0.0	0.3	0.5
	0.25	101.0		101.0	0.0		

11. Peak C Sound level

UUC Setting FAST / C / 20-140	Anticipated REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
STD Setting Complete cycle	135.4	135.6	-0.20	0.2	2.0
	134.4	134.2	-0.20		
Positive half cycle	134.4	134.2	-0.20	0.2	1.0
Negative half cycle	134.4	134.2	-0.20		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PNS-708-SLM-01 Rev.2 Issue date 01/07/19



Certificate No : 23-SLM-041
Request No : Req-2023-0295

12. Overload indication

UUC Setting FAST / A / 20-140	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
STD Setting Positive one-half cycle	143.7	0.2	1.5
	143.6		
Deviated	0.1	0.2	1.5
Deviated	0.1		

13. High Level Stability

UUC Setting FAST / A / 20-140	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
STD Setting Initial	139.0	0.1	0.1
	139.0		
Deviated	0.0	0.1	0.1
Deviated	0.0		

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
PNS-708-SLM-01 Rev.2 Issue date 01/07/19



73-TISTR

73-TISTR

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197

MTC No. EEL BP. 60/0166

CALIBRATION CERTIFICATE

Submitted by : THAI ENVIRONMENTAL TECHNIC LIMITED.
Address : 1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphansung, Bangkok 10240.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator
Manufacturer : Tonnars
Model : TM-100
Serial No. : 181203570
Ambient Environment
Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

3. Programmable Attenuator Tanagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 10 Jan. 2023

Date of Calibration : 16 Jan. 2023

1 / 3

Advertising the Report/Certificate and publicly of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

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73-TISTR

73-TISTR

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197

MTC No. EEL BP. 60/0166

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20 μPa at 1000 Hz

Acoustic Output in dB re 20 μPa , Corrected to Reference Conditions : 101.325 kPa, 23.0°C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	94.26	0.26	± 0.10	$\pm 0.75 \text{ dB}$

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	989.3	-10.7	± 1.5	$\pm 2.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	2.20	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 16 Jan. 2023

2 / 3

The results relate only to the items tested/calibrated or value assigned. Advertising the Report/Certificate and publicly of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.4

Head Office : 35 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 17120, Thailand
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E-mail : s.malee@tistr.or.th



77-TISTR

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197

MTC No. EEL BP. 60/0166

Nominal Output of Unit Under Test = 114 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions : 101.325 kPa, 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	113.96	-0.04	± 0.10	-0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	985.1	-14.9	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	2.60	± 0.60	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :

(Mr. Weerachai Deechaiyae)



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Jan. 2023

Date of Issue : 18 Jan. 2023

Ref : 3011266011000062001

End of Certificate

3 / 3

Advertising the Report Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
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FM.BL.MTC.002 Rev.04



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter
Calibrator : TENMARS Sound Calibrator TM-100
Standard : IEC 60942
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB
Frequency : at 1,000 Hz ±1%
Calibrator Serial NO. : 181203570
Calibration Date : 31-July-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25.8 °C
Relative Humidity(50±15 %) : 45.0 %RH
Due Date of Calibrate : 31-Aug-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust		After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2			
18	ACO	6226	070048	94.1	94.1	94.1	0.1	PASS
19	ACO	6226	070047	94.1	94.1	94.1	0.1	PASS
20	ACO	6226	070048	93.9	93.9	93.9	0.1	PASS
21	ACO	6226	070049	94.2	94.2	94.2	0.2	PASS
23	RION	NL-21	00487676	93.9	93.9	93.9	0.1	PASS
25	ACO	6226	100098	94.1	94.1	94.1	0.1	PASS
26	ACO	6226	100099	93.9	93.9	93.9	0.1	PASS
28	ACO	6226	100101	93.9	93.9	93.9	0.1	PASS
29	ACO	6226	100102	94.1	94.1	94.1	0.1	PASS
30	ACO	6226	100106	94.2	94.2	94.2	0.2	PASS

Calibration By :

Approve by :

The Environmental Technic Limited 1/6 Soi Ramkhamnieng 145 Kwangklai Saphan Sung Bangkok 10240 Thailand
• Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7799 • admin@tetr1995.com • www.tetr1995.com



TET

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter
Calibrator : TENMARS Sound Calibrator TM-100
Standard : IEC 60942
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB
Frequency : at 1,000 Hz ±1%
Calibrator Serial NO. : 181203570

Calibration Date : 24-July-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25.8 °C
Relative Humidity(50±15 %) : 45.0 % RH
Dued Date of Calibrate : 31-Aug-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ก.ว.ก.1	ก.ว.ก.2	ก.ว.ก.3			
51	ACO	6236	94.0	93.7	93.7	93.7	94.0	0.3	PASS
			114.0	113.6	113.6	113.6	113.6		
52	ACO	6226	94.0	93.9	93.9	93.9	94.0	0.1	PASS
			114.0	113.9	113.9	113.9	113.9		
53	ACO	6226	94.0	94.1	94.1	94.1	94.0	0.1	PASS
			114.0	114.2	114.2	114.2	114.2		
54	ACO	6226	94.0	93.9	93.9	93.9	94.0	0.1	PASS
			114.0	113.8	113.8	113.8	113.8		
55	ACO	6226	94.0	94.0	94.0	94.0	94.0	0.0	PASS
			114.0	114.0	114.0	114.0	114.0		
56	ACO	6226	94.0	93.9	93.9	93.9	94.0	0.1	PASS
			114.0	113.9	113.9	113.9	113.9		
57	ACO	6226	94.0	94.0	94.0	94.0	94.0	0.0	PASS
			114.0	114.0	114.0	114.0	114.0		
58	ACO	6226	94.0	94.0	94.0	94.0	94.0	0.0	PASS
			114.0	114.0	114.0	114.0	114.0		
59	ACO	6226	94.0	93.9	93.9	93.9	94.0	0.1	PASS
			114.0	113.9	113.9	113.9	113.9		
60	ACO	6226	94.0	94.1	94.1	94.1	94.0	0.1	PASS
			114.0	114.1	114.1	114.1	114.1		

Calibration By :
Approve by :



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Certificate of Calibration

Certificate Number : SPR23030020-1 Page : 1 of 3
Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Equipment Name : Noise Dose Meter
Manufacturer : SOUNDTEK
Model : ST-130
Serial Number : 220100056
ID. Number : No.36
Environmental Conditions
Ambient Temperature : 23 °C ± 3 °C Received Date : 01 Mar 2023
Relative Humidity : 50 % ± 15 % Calibration Date : 07 Mar 2023
Location of Calibration : In-Lab Recommend Due Date : 07 Mar 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 08 Mar 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent. National metrology institutes, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Karoon Pengsalung Approved by :
Calibration Officer (Mr. Prayoon Topart)
Authorized Signatory



Calibration Report

Certificate Number : SPR23030020-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
Sound Level Calibrator	ST-120	211203773	EELBP.114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23030020-1

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A		UUC Reading		Error		Uncertainty (\pm)	Unit : dB
Standard Setting		Fast	Slow	Fast	Slow		
94		94.0	94.0	0.0	0.0	0.15	
114		113.9	113.9	-0.1	-0.1	0.15	

Select C		UUC Reading		Error		Uncertainty (\pm)	Unit : dB
Standard Setting		Fast	Slow	Fast	Slow		
94		94.0	94.0	0.0	0.0	0.15	
114		114.0	114.0	0.0	0.0	0.15	

Select Z		UUC Reading		Error		Uncertainty (\pm)	Unit : dB
Standard Setting		Fast	Slow	Fast	Slow		
94		94.0	94.0	0.0	0.0	0.15	
114		114.0	114.0	0.0	0.0	0.15	

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23030020-3
Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Page : 1 of 3

Equipment Name : Noise Dose Meter
Manufacturer : SOUNDTEK
Model : ST-130
Serial Number : 220100057
ID. Number : No.37

Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 01 Mar 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 07 Mar 2023
Location of Calibration : In-Lab Recommend Due Date : 07 Mar 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 08 Mar 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Karoon Pengsalung
Calibration Officer
Approved by : 
(Mr.Prayoon Topart)
Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23030020-3

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23030020-3

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		113.9	113.9	-0.1	-0.1	0.15

Unit : dB

Select C	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		114.0	114.0	0.0	0.0	0.15

Unit : dB

Select Z	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		113.9	113.9	-0.1	-0.1	0.15

Unit : dB

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate No. : 23H553

Page : 1 of 2

Equipment : Thermal Environment Monitor

Manufacturer : JANTYTECH

Model : JT2011-E2A

Serial No : 3522210140

ID No.: HD 2

Condition As-Received: Used Item

Received Date: 03 March 2023

Calibration Date: 09 March 2023

Reference: to 13 March 2023

Ambient Temperature: 2303-0119DSC

Relative Humidity: (25 ± 3) °C

(50 ± 20) %

Submitted by: Thal Environmental Technic Limited

1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung,
Bangkok 10240

Procedure used:

Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration:

1. Reference standards instruments :

Instrument

1) Handheld Thermometer With Sensor

2) The certificate is valid only to the item calibrated on date and place of calibration.

3) This Certificate is traceable to the International System of Unit maintained at:-

- National Institute of Metrology Thailand (NIMT)

Model

1521

Serial No.

A5A339

Certificate No.

221251

Due Date

12 Oct 2023

Calibrated by : Chakrit Waewanjua

Issue Date : 17 March 2023

Approved Signatory :

[] Chakrit Waewanjua

[] Ponthipha Taneyakul

[] Viporn Tantiyawutti



Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for Ta

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.021	19.8	-0.221	0.42
29.990	29.9	-0.090	0.42
40.012	40.0	-0.012	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_{hw}

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.021	19.8	-0.221	0.42
29.990	29.9	-0.090	0.42
40.012	40.0	-0.012	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_g

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.021	20.0	-0.021	0.42
29.990	29.9	-0.090	0.42
40.012	39.9	-0.112	0.42

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

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a 1153237



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H557
Page : 1 of 2

Equipment : Thermal Environment Monitor

Manufacturer : JANTYTECH

Model : JT2011-E2A

Serial No. : 3422210144

ID No. : HD 6

Condition As-Received: Used Item

Received Date : 03 March 2023

Calibration Date : 09 March 2023

Reference : to 13 March 2023

2303-0118DSC

Ambient Temperature : (25 ± 3) °C

Relative Humidity : (50 ± 20) %

Submitted by : Thai Environmental Technic Limited

1/6 Soi Ramkhamhaeng 145, Khwaeng/Khel Saphan Sung,
Bangkok 10240

Procedure used :

Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument

1) Handheld Thermometer With Sensor

Model

1521

Serial No.

AS4339

Certificate No.

221251

Due Date

12 Oct 2023

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certification is traceable to the International System of Unit maintained at-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Chakrit Waewanjua

Issue Date : 17 March 2023

Approved Signatory :

[] Chakrit Waewanjua

[] Ponthippa Tameysakul

[x] Viporn Tantiyawutti

B 0310153



Cert. No.: 23H557
Page: 2 of 2

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_a

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
20.025	19.9	-0.125	0.42
30.018	29.7	-0.318	0.42
40.007	39.8	-0.207	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_{hw}

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
20.025	20.0	-0.025	0.42
30.018	29.7	-0.318	0.42
40.007	39.7	-0.307	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_g

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
20.025	19.8	-0.225	0.42
29.990	29.7	-0.290	0.42
40.012	39.7	-0.312	0.42

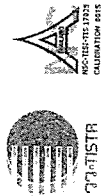
UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

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Signature

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Request No. : 22-66 / 0597

MTC No. : PSL-P 0152 / 66

CERTIFICATE OF CALIBRATION

Nomenclature : Digital Lux Meter

Serial No. : Q066345

Maker : DIGICON

Model : LX-50

Customer : THAI ENVIRONMENTAL TECHNIC LIMITED

Address : 1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung, Bangkok 10240

Date of receipt : 7 June 2023

Date of calibration : 19 June 2023

Place of calibration : Photometry and Temperature Standards Laboratory, MTC. (Bangpoo)

Basis of calibration : calibration at 0 ~ 5000 lux.

Condition of calibration : - Ambient temperature : $(25 \pm 2) ^\circ\text{C}$

- Relative humidity : $(60 \pm 20) \%$

Reference Standard :

Working Standard Luminous Intensity Lamp, Serial No.: FEL003 and 3501, can be traceable to international system of units (SI), through calibration certificate MTC No. PSL-P 131/66 and PSL-P 132/66, date of calibration 12 May 2023.

Traceability :

This certificate is traceable to SI units through the National Institute of Metrology (Thailand) calibration certificate No. TP-1010-23, TP-1011-23 and TP-1012-23

Support Equipment :

1. Photometric bench, 3.0 meter long
2. DC power supply, Serial No.: BC - 341006035007/2
3. Digital Multimeter, Model : R 6551, S/N : 92041186 and 92041192

Calibration Procedure : The measurement was done in accordance with WICP-10.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

page 1 of 2

R. P.

Advising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of NIM.

Head Office

35 Mu 3, Sanbon Khlong Ha, Amphoe Khlong Luang,
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FM/LMTC.002 Rev.4



MTC No. : PSL-P 0152 / 66

Request No. : 22-66 / 0597

Serial No. : Q066345

Results :

UUC Range (lux)	Standard (lux)	*UUC Reading (lux)	Uncertainty of Measurement \pm (lux)
2000	100	103	2.3
	500	506	11
	1000	1006	22
	1500	1506	33
	2000	1999	44
20000 ($\times 10$)	2000	201	50
	3000	302	70
	4000	403	90
	5000	502	110
50000 ($\times 100$)	2000	19	80
	3000	29	90
	4000	38	110
	5000	47	130

Note : *UUC = Unit Under Calibration.

...end of certificate...

Calibrated by :

Rattana G.
(Ms. Rattanawadee Pholprom)

Approved by :

P. Sanchai
for (Mr. Kamchai-Singhapitva)
Director

Photometry and Temperature Standards Laboratory

Ref. : 2012266060702194001

Issued date : 21 June 2023

page 2 of 2

The results relate only to the items tested/calibrated or value assigned.
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FM.BLMTC.002 Rev.4

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Office/Laboratory
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Amphoe Muang Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sura@tistr.or.th

ภาคผนวก ฉ

หนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-236





ที่ อก ๐๓๐๑(๑)/ ๙ ๘ ๙ ๖

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐
๒๒ มิถุนายน ๒๕๖๖

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓ มีนาคม ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแบบทึบย่นหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด จำนวน ๒๘ แผ่น

ตามที่หนังสือที่อ้างถึง บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียน
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๓๖ สลนที่ต่งเลขที่ ๑/๖ ขอยรณคำค่าแห่ง ๑๕๕๕ แขวงสะพานสูง
เขตสะพานสูง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด ต่ออายุหนังสือรับขึ้น
ทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

- ๑) นายณัฐพงศ์ โคตะมา ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๑
- ๒) นางสาววรัญญา ประทุมแดง ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๒
- ๓) นางพรทิพย์ เพชรชัย ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๓
- ๔) นายสมชาย ปิยะวรสุกุล ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๔
- ๕) นายประมวล มูลสาร ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๕
- ๖) นายรัฐพล สุขดี ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๖

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

- ๑) นางสาวพณีน อัครชัยสุวิกรม ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๑
- ๒) นางสาวกมลลักษณ์ ดิมงคล ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๒
- ๓) นางสาวกนกวรรณ เริ่มประชาธิปไตย ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๓
- ๔) นางสาววิจิตรณ ศรีสุวรรณ ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๔
- ๕) นางสาวอนิดา กุมาชาติ ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๕
- ๖) นางสาวนาลินี มณีรัตน์ ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๖
- ๗) นางสาวพัชรพรพรณ สว่างภพ ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๗
- ๘) นายสุริยพงศ์ ยงยุทธ ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๘
- ๙) นางสาวอภักดิ์ สี่แท้ ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๐๙
- ๑๐) นางสาวศิริพร กาจิต ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๐
- ๑๑) นายสุชาติ ศรีบุญ ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๑
- ๑๒) นายเกียรติศักดิ์ วันดี ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๒

๑๓) นายจิรวัฒน์...

- ๒ -

- | | |
|--------------------------------|----------------------------|
| ๑๓) นายจิรวัฒน์ อินทะเสย | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๓ |
| ๑๔) นางสาวนิตยา เบญจนา | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๔ |
| ๑๕) นางสาวณัฐญา สารแสง | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๕ |
| ๑๖) นายกิตติศักดิ์ เมืองงาม | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๖ |
| ๑๗) นายเทพพงษ์ เขียวเกาะ | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๗ |
| ๑๘) นายเฉลิมวุฒิ พูลสงวน | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๘ |
| ๑๙) นางสาวบุษศิริ ออธร | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๑๙ |
| ๒๐) นางสาววรรณศิริ สุริยวงศ์ | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๐ |
| ๒๑) นายวิฑูรย์ วลัยรัตน์ | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๑ |
| ๒๒) นางสาวกัญชดา จอกสูงเนิน | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๒ |
| ๒๓) นางสาวสุกัญญา อยู่นิม | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๓ |
| ๒๔) นางสาวลลิตา ตริโยดม | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๔ |
| ๒๕) นายเจอ แซ่พัว | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๕ |
| ๒๖) นายอรรถพล วงศ์สวัสดิ์ | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๖ |
| ๒๗) นายประยัต จิวเดช | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๗ |
| ๒๘) นายเบญจพล กรังคคา | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๘ |
| ๒๙) นายวีรพล บุคสา | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๒๙ |
| ๓๐) นายพิเชษฐ อยู่ติ่มมัย | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๓๐ |
| ๓๑) นายณัฐดนัย ศรีรัตนชัยวาลย์ | ทะเบียนเลขที่ ๖-๒๓๖-๖-๐๐๓๑ |

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูลหรือ
วัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๓ มีนาคม ๒๕๖๙ หากประสงค์จะต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ
กรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นสุดของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ดังนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ทั้งนี้โปรดกรังงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ
๖.๖. ๑๖.๖

— (นายประสม คำรณพงษ์)
ผู้อำนวยการวิจัยและพัฒนาย้อมเล็หิพห
ปฏิบัติการการเนอับคิรเมรังกษุสทหกรม

กองวิจัยและพัฒนาย้อมเล็หิพหกรม
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบเล็หิพหและทะเบียนห้องปฏิบัติการ
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๕๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@div.mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนาอุตสาหกรรมสีเขียว"



เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เพคนิคสิ่งแวดล้อมไทย จำกัด เลขทะเบียน ๖-๒๓๖
ที่ อก ๐๓๑๐(๑)/ ๙ ๙ ๙ ๖ ลงวันที่ ๒๒ มิถุนายน ๒๕๖๖
ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๓๗ รายการ
นับเสียจำนวน 40 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
2	Arsenic	Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(a)
3	Barium	1) Digestion, Direct Nitrous Oxide-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
4	α-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
5	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
6	Biochemical Oxygen Demand	5-Day BOD Test, Azide Modification Method ^(a)
7	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
8	Chemical Oxygen Demand	Closed Reflux, Titrimetric Method ^(a)
9	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
10	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
11	Color	ADMI Weighted-Ordinate Spectrophotometric Method ^(a)
12	Copper	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
13	Cyanide	Distillation, Colorimetric Method ^(a)
14	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
15	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
16	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)

17 Endosulfan I...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
18	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
19	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
20	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
21	Formaldehyde	Distillation, Colorimetric Method ^(a)
22	Free Chlorine	DPD Ferrous Titrimetric Method ^(a)
23	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
24	Heptachlor Epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
25	Hexavalent Chromium	Colorimetric Method ^(a)
26	Lead	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
27	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
28	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(a)
29	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
30	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ^(a) 2) Soxhlet Extraction Method ^(a)
31	pH	Electrometric Method ^(a)
32	Phenols	Distillation, Direct Photometric Method ^(a)
33	Selenium	Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(a)
34	Sulfide	1) Iodometric Method ^(a) 2) Methylene Blue Method ^(a)
35	Temperature	Laboratory and Field Methods ^(a)
36	Total Dissolved Solids	Dried at 180 °C ^(a)
37	Total Kjeldahl Nitrogen	Macro-Kjeldahl Method ^(a)
38	Total Suspended Solids	Dried at 103-105 °C ^(a)

39 Trivalent Chromium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
39	Trivalent Chromium	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^(a)
40	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)

น้ำดื่ม จำนวน 122 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
2	Acetone	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
5	Antimony	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a)
6	Arsenic	3) Digestion, Inductively Coupled Plasma Method ^(a) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(a)
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
8	Barium	1) Digestion, Direct Nitrous Oxide-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a)
9	Benz(a)anthracene	3) Digestion, Inductively Coupled Plasma Method ^(a) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
10	Benzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)

13 Benzoic acid...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
16	Beryllium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 2) Digestion, Inductively Coupled Plasma Method ^(a)
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
20	Bromoform	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
21	Butanol	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
23	Cadmium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 2) Digestion, Inductively Coupled Plasma Method ^(a)
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
25	Carbon disulfide	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
29	Chlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
31	Chloroform	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)

32 Chromium...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
32	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ^(d) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(d) 3) Digestion, Inductively Coupled Plasma Method ^(d)
33	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ^(d) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method; Colorimetric Method; Calculation ^(d) 3) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^(d)
34	Chromium (VI)	Colorimetric Method ^(d)
35	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)
36	Cyanide	Distillation, Colorimetric Method ^(d)
37	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
38	DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
39	DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
40	DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
41	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)
42	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)
43	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
44	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
45	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
46	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
47	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
48	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
49	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
50	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
51	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
52	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
53	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
54	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
55	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)
56	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
57	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
58	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
59	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
60	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)
61	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
62	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
63	Ethylbenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
64	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)
65	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)
66	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
67	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
68	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
69	n-Hexane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(d)
70	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
71	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
72	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic Method ^(d)
73	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(d)

ลำดับที่	สารเคมี	วิธีวิเคราะห์
74	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
75	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
76	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
77	Lead	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a)
78	Manganese	2) Digestion, Inductively Coupled Plasma Method ^(a) 1) Digestion, Direct Air-Acetylene Flame Method ^(a)
79	Mercury	2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a) 3) Digestion, Inductively Coupled Plasma Method ^(a)
80	Methanol	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(a)
81	Methoxychlor	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
82	Methyl bromide	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
83	Methylene chloride	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
84	2-Methylphenol	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
85	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
86	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
87	Naphthalene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
88	Nickel	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a)
89	Nitrobenzene	2) Digestion, Inductively Coupled Plasma Method ^(a)
90	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)

ลำดับที่	สารเคมี	วิธีวิเคราะห์
91	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
92	Polychlorinated Biphenyls PCB-1016 PCB-1221 PCB-1232 PCB-1242 PCB-1248 PCB-1254 PCB-1260	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a) 1) Distillation, Direct Photometric Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
93	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
94	pH	Electrometric Method ^(a)
95	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
96	Phenol	1) Distillation, Direct Photometric Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
97	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
98	Selenium	Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(a)
99	Silver	1) Digestion, Direct Air-Acetylene Flame Method ^(a) 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ^(a)
100	Styrene	3) Digestion, Inductively Coupled Plasma Method ^(a) Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
101	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
102	Tetrachloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
103	Toluene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ^(a)
104	Toxaphene	Mass Spectrometric Method ^(a)
105	TPH (C ₈ -C ₉)	Liquid-Liquid Extraction, Gas Chromatographic/ Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
106	TPH (C ₈ -C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ⁽²²⁾
107	TPH (C ₁₆ -C ₃₅)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ⁽²²⁾
108	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
109	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
110	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
111	Trichloroethylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
112	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
113	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
114	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
115	Vanadium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
116	Vinyl acetate	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
117	Vinyl chloride	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
118	m-Xylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
119	o-Xylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
120	p-Xylene	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
121	Xylene (Total)	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
122	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

อากาศเสีย...

อากาศเสีย (ปล่องระบาย) จำนวน 18 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 3) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ⁽⁵⁾ Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁵⁾ Instrumental Analyzer Method ⁽⁵⁾ Absorption Sampling, Ion Chromatographic Method ⁽⁵⁾ 1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ Adsorption Sampling, Gas Chromatographic Method ⁽⁵⁾ Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) ⁽⁵⁾ Absorption Sampling, Ion Chromatographic Method ⁽⁵⁾ Absorption Sampling, Ion Chromatographic Method ⁽⁵⁾ Absorption Sampling, Iodometric Method ⁽⁵⁾ 1) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽⁵⁾ 2) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽⁵⁾ 3) Isokinetic Sampling, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ⁽⁵⁾ Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁵⁾ Ringelmann's Method ⁽²⁾ 1) Absorption Sampling, Phenoldisulfonic acid Method ⁽⁵⁾ 2) Instrumental Analyzer Method ⁽⁵⁾
2	Arsenic	
3	Carbon monoxide	
4	Chlorine	
5	Copper	
6	Cresol	
7	Dioxins/Furans	
8	Hydrogen Chloride	
9	Hydrogen Fluoride	
10	Hydrogen Sulfide	
11	Lead	
12	Mercury	
13	Opacity	
14	Oxides of Nitrogen	

15 Sulfur dioxide....

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	Sulfur dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ^[5] 2) Instrumental Analyzer Method ^[5]
16	Sulfuric acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ^[5]
17	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ^[5]
18	Xylene	Adsorption Sampling, Gas Chromatographic Method ^[5]

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 36 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^[1,10,24] 2) Solid-Phase Extraction, Gas Chromatographic Method ^[10,24] 3) Soxhlet Extraction, Gas Chromatographic Method ^[11,24]
2	Antimony	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^[1,6,15] 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[1,6,16] 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,14] 4) Digestion, Flame Atomic Absorption Spectrometric Method ^[7,15] 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[7,16] 6) Digestion, Inductively Coupled Plasma Method ^[7,14]
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[1,6,17] 2) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^[7,17]
4	Barium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^[1,6,15] 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[1,6,16] 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,14]

4) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
5	Beryllium	4) Digestion, Flame Atomic Absorption Spectrometric Method ^[7,15] 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[7,16] 6) Digestion, Inductively Coupled Plasma Method ^[7,14] 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^[1,6,15] 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[1,6,16] 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,14] 4) Digestion, Flame Atomic Absorption Spectrometric Method ^[7,15] 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[7,16] 6) Digestion, Inductively Coupled Plasma Method ^[7,14]
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^[1,6,15] 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[1,6,16] 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,14] 4) Digestion, Flame Atomic Absorption Spectrometric Method ^[7,15] 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[7,16] 6) Digestion, Inductively Coupled Plasma Method ^[7,14]
7	Chlordane	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^[1,10,24] 2) Solid-Phase Extraction, Gas Chromatographic Method ^[10,24] 3) Soxhlet Extraction, Gas Chromatographic Method ^[11,24]
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^[1,6,15] 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^[1,6,16]

3) Waste Extraction...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
9	Chromium (III)	3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14)
		4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15)
		5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16)
		6) Digestion, Inductively Coupled Plasma Method ^(7.14)
		1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(1.6.15.18)
		2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(1.6.16.18)
10	Chromium (VI)	3) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(1.6.14.18)
		4) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7.8.15.18)
		5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7.8.16.18)
		6) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7.8.14.18)
		1) Waste Extraction, Colorimetric Method ^(1.18)
		2) Alkaline Digestion, Colorimetric Method ^(8.18)
11	Cobalt	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15)
		2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16)
		3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14)
		4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15)
		5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16)
		6) Digestion, Inductively Coupled Plasma Method ^(7.14)

12 Copper...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15)
		2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16)
		3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14)
		4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15)
		5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16)
		6) Digestion, Inductively Coupled Plasma Method ^(7.14)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1.9.24)
		2) Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
14	DDD	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1.10.24)
		2) Solid-Phase Extraction, Gas Chromatographic Method ^(10.24)
15	DDE	3) Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
		1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1.10.24)
16	DDT	2) Solid-Phase Extraction, Gas Chromatographic Method ^(10.24)
		3) Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
17	Dieldrin	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1.10.24)
		2) Solid-Phase Extraction, Gas Chromatographic Method ^(10.24)

3m

18 Endrin...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
18	Endrin	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1,10,24) 2) Solid-Phase Extraction, Gas Chromatographic Method ^(1,10,24) 3) Soxhlet Extraction, Gas Chromatographic Method ^(1,11,24)
19	Heptachlor	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1,10,24) 2) Solid-Phase Extraction, Gas Chromatographic Method ^(1,10,24) 3) Soxhlet Extraction, Gas Chromatographic Method ^(1,11,24)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1,6,16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14)
21	Lindane	4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 6) Digestion, Inductively Coupled Plasma Method ^(7,14) 1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1,10,24) 2) Solid-Phase Extraction, Gas Chromatographic Method ^(10,24) 3) Soxhlet Extraction, Gas Chromatographic Method ^(1,11,24)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1,6,19) 2) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽²⁰⁾
23	Methoxychlor	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1,10,24) 2) Solid-Phase Extraction, Gas Chromatographic Method ^(10,24)

3) Soxhlet...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
24	Mirex	3) Soxhlet Extraction, Gas Chromatographic Method ^(1,11,24) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,24) 2) Soxhlet Extraction, Gas Chromatographic Method ^(1,11,24)
25	Molybdenum	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1,6,16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 6) Digestion, Inductively Coupled Plasma Method ^(7,14)
26	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1,6,15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1,6,16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,6,14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 6) Digestion, Inductively Coupled Plasma Method ^(7,14)
27	Polychlorinated Biphenyls Aroclor 1016 Aroclor 1221 Aroclor 1232 Aroclor 1242 Aroclor 1248 Aroclor 1254 Aroclor 1260 2,4,4'-Trichlorobiphenyl 2,2',5,5'-Tetrachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,9,23) 2) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1,10,23) 3) Soxhlet Extraction, Gas Chromatographic Method ^(1,11,23)

2,2,4,5,5'...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
28	2,2',4,5,5'-Pentachlorobiphenyl 2,2',3,4,4',5'- Hexachlorobiphenyl 2,2',4,4',5,5'- Hexachlorobiphenyl 2,2',3,4,4',5,5'- Heptachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1.9.24) 2) Soxhlet Extraction, Gas Chromatographic Method ^(1.1.24) 1) Waste Extraction, Digestion, Hydride Generation/ Atomic Absorption Spectrometric Method ^(1.6.21) 2) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7.21)
29	Selenium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16)
30	Silver	3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 6) Digestion, Inductively Coupled Plasma Method ^(7.14)
31	Thallium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 6) Digestion, Inductively Coupled Plasma Method ^(7.14)

32 Toxaphene....

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
32	Toxaphene	1) Waste Extraction, Solid-Phase Extraction, Gas Chromatographic Method ^(1.10.24) 2) Solid-Phase Extraction, Gas Chromatographic Method ^(10.24) 3) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(1.1.27) 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(1.12.28) 2) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.28) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 6) Digestion, Inductively Coupled Plasma Method ^(7.14)
33	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.28) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 6) Digestion, Inductively Coupled Plasma Method ^(7.14)
34	Vanadium	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.28) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 6) Digestion, Inductively Coupled Plasma Method ^(7.14)
35	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.28) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 6) Digestion, Inductively Coupled Plasma Method ^(7.14)
36	Zinc	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(13.28) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(1.6.15) 2) Waste Extraction, Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(1.6.16) 3) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.6.14) 4) Digestion, Flame Atomic Absorption Spectrometric Method ^(7.15) 5) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 6) Digestion, Inductively Coupled Plasma Method ^(7.14)

ฉบับ...

ดิน จำนวน 121 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
3	Aldrin	Soxhlet Extraction, Gas Chromatographic Method ^(11,24)
4	Anthracene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
5	Antimony	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
6	Arsenic	Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,17)
7	Atrazine	Soxhlet Extraction, Gas Chromatographic Method ^(11,24)
8	Barium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
9	Benz(a)anthracene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
11	Benz(b)fluoranthene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
12	Benz(k)fluoranthene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
13	Benzoic acid	Soxhlet Extraction, Gas Chromatographic Method ^(11,23)
14	Benzo(a)pyrene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
15	Benzo(g,h,i)perylene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
16	Beryllium	Mass Spectrometric Method ^(11,27) 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15)

2) Digestion...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
17	Bis(2-chloroethyl)ether	2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
18	Bis(2-ethylhexyl)phthalate	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
19	Bromodichloromethane	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
22	Butyl benzyl phthalate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
23	Cadmium	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27) 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
24	Carbazole	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
27	Chlordane	Soxhlet Extraction, Gas Chromatographic Method ^(11,24)
28	p-Chloroaniline	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
32	Chromium	Mass Spectrometric Method ^(13,26) 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15)

2) Digestion...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
33	Chromium (III)	2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.14) 1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7.8,15,18) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7.8,16,18) 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7.8,19,18)
34	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8.18)
35	Chrysene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11.27)
36	Cyanide	1) Extraction, Distillation, Titrimetric Method ^(28,29,30) 2) Extraction, Distillation, Colorimetric Method ^(28,29,30)
37	2,4-D	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
38	DDD	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
39	DDE	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
40	DDT	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
41	Dibenz(a,h)anthracene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11.27)
42	Di-n-butyl phthalate	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11.27)
43	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
44	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
45	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
46	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
47	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
48	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)

49 cis-1,2-Dichloroethylene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
49	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
50	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
51	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
52	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
53	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
54	Dieldrin	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
55	Diethyl phthalate	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11.27)
56	2,4-Dimethylphenol	Soxhlet Extraction, Gas Chromatographic Method ^(11.23)
57	2,4-Dinitrophenol	Soxhlet Extraction, Gas Chromatographic Method ^(11.23)
58	2,4-Dinitrotoluene	Soxhlet Extraction, Gas Chromatographic Method ^(11.23)
59	2,6-Dinitrotoluene	Soxhlet Extraction, Gas Chromatographic Method ^(11.23)
60	Di-n-Octyl phthalate	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11.27)
61	Endosulfan	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
62	Endrin	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
63	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
64	Fluoranthene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11.27)
65	Fluorene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11.27)
66	Heptachlor	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
67	Heptachlor epoxide	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
68	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
69	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13.26)
70	α-HCH	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
71	β-HCH	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)
72	γ-HCH	Soxhlet Extraction, Gas Chromatographic Method ^(11.24)

73 Hexachlorocyclopentadiene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
73	Hexachlorocyclopentadiene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
74	Hexachloroethane	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
75	Indeno(1,2,3-cd)pyrene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
76	Isophorone	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
77	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
78	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
79	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽²⁰⁾
80	Methanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
81	Methoxychlor	Soxhlet Extraction, Gas Chromatographic Method ^(11,20)
82	Methyl bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
83	Methylene chloride	Mass Spectrometric Method ^(13,26)
84	2-Methylphenol	Soxhlet Extraction, Gas Chromatographic Method ^(11,23)
85	2-Methylnaphthalene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
86	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
87	Naphthalene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
88	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
89	Nitrobenzene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
90	N-Nitrosodiphenylamine	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
91	N-Nitrosodi-n-propylamine	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
92	Polychlorinated Biphenyls Aroclor 1016 Aroclor 1221 Aroclor 1232 Aroclor 1242 Aroclor 1248 Aroclor 1254 Aroclor 1260 2,2',5,5'-Tetrachlorobiphenyl 2,2',4,5,5'-Pentachlorobiphenyl 2,2',3,4,4',5'- Hexachlorobiphenyl 2,2',4,4',5,5'- Hexachlorobiphenyl 2,2',3,4,4',5,5'- Heptachlorobiphenyl Pentachlorophenol Phenanthrene	Soxhlet Extraction, Gas Chromatographic Method ^(11,25) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27) Soxhlet Extraction, Gas Chromatographic Method ^(11,23) Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,21) 1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
93	Phenol	Soxhlet Extraction, Gas Chromatographic Method ^(11,20)
94	Pyrene	Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(11,27)
95	Selenium	Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,21)
96	Silver	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
99	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
100	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
101	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
102	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
103	Toxaphene	Soxhlet Extraction, Gas Chromatographic Method ^(11,20)
104	TPH (C ₅ -C ₉)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
105	TPH (C ₈ -C ₁₆)	Soxhlet Extraction, Gas Chromatographic Method ^(11,22)
106	TPH (C ₁₅ -C ₃₃)	Soxhlet Extraction, Gas Chromatographic Method ^(11,22)
107	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
108	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
109	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
110	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
111	2,4,5-Trichlorophenol	Soxhlet Extraction, Gas Chromatographic Method ^(11,23)
112	2,4,6-Trichlorophenol	Soxhlet Extraction, Gas Chromatographic Method ^(11,23)
113	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
114	Vanadium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,13) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)
115	Vinyl acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
116	Vinyl chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
117	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
118	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
119	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)

120 Xylene (Total)

gmp

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
120	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(13,26)
121	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,15) 2) Digestion, Graphite Furnace Atomic Absorption Spectrometric Method ^(7,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,14)

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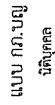
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ภาคผนวก ช

ใบอนุญาตเป็นผู้ตรวจวัดและวิเคราะห์สภาวะการทำงาน
เกี่ยวกับความร้อน แสงสว่าง เสียง และสารเคมีอันตราย
ในบรรยากาศ





ใบอนุญาต


เป็นผู้ให้บริการตรวจวัดระดับความเข้มข้นของสารเคมีอันตราย
ในบรรยากาศของสถานที่ทำงาน และสถานที่เก็บรักษาสารเคมีอันตราย

ใบอนุญาตนเลขที่ ๐๒๐๑-๐๓-๒๕๖๔-๐๐๐๓

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๑๔/๑๕ ธันวาคม พ.ศ. ๒๕๖๔

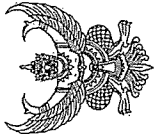
ให้ไว้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔


(นายสมพงษ์ กวางแก้ว)
ผู้ตรวจราชการกรม ปฏิบัติราชการ
อธิบดีกรมสวัสดิการและคุ้มครอง

๑๕ ธันวาคม พ.ศ. ๒๕๖๔ ถึงวันที่ ๑๓ ธันวาคม พ.ศ. ๒๕๖๕

เพื่อให้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๕

(นายสมพงษ์ กวางแก้ว)
ผู้ตรวจราชการกรม ปฏิบัติราชการแทน
อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน



แบบ กภ.บุญ
นิติบุคคล

กรมสวัสดิการและคุ้มครองแรงงาน

ใบอนุญาต

เป็นผู้ให้บริการวิเคราะห์ระดับความเข้มแข็งของสารเคมีอันตราย
ในบรรยากาศของสถานที่ทำงาน และสถานที่เก็บรักษาสารเคมีอันตราย

ใบอนุญาตเลขที่ ๑๒๐๒๕-๐๓๖๕๖๔-๐๐๐๓

อนุญาตให้.....บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

เลขทะเบียนนิติบุคคล.....๐๑๒๕๕๗๗๑๐๘๕๖๓

ตั้งอยู่ เลขที่ ๑๖ ซอยรามคำแหง ๑๔๕ แขวงสะพานสูง เขตสะพานสูง กรุงเทพมหานคร

เป็นผู้ให้บริการวิเคราะห์ระดับความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน ตามกฎหมายว่าด้วย
กฎหมายอาชีวอนามัยและความปลอดภัย อาชีวอนามัย และสภาพแวดล้อม
ในการทำงานเกี่ยวกับสารเคมีอันตราย พ.ศ. ๒๕๕๖ ในกรณีเป็นผู้ให้บริการตรวจวัดและวิเคราะห์ระดับความ
เข้มข้นของสารเคมีอันตรายในบรรยากาศของสถานที่ทำงาน และสถานที่เก็บรักษาสารเคมีอันตราย
ประกอบกับกฎกระทรวงการขึ้นทะเบียนและการอนุญาตให้บริการเพื่อส่งเสริมความปลอดภัย อาชีวอนามัย
และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๖๔ แห่งพระราชบัญญัติความปลอดภัย อาชีวอนามัย
และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๕๔ โดยมีบุคลากรหรือวิทยากร จำนวน ๘ ราย

ทั้งนี้ ตั้งแต่วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔ ถึงวันที่ ๑๓ ธันวาคม พ.ศ. ๒๕๖๗

ให้ไว้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔

(นายสมพงษ์ กวางแก้ว)
ผู้ตรวจราชการกรม ปฏิบัติราชการแทน
อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน

รายชื่อบุคลากรแบบท้ายใบอนุญาต
เป็นนิติบุคคลผู้ให้บริการวิเคราะห์ระดับความเข้มแข็งของสารเคมีอันตรายในบรรยากาศของสถานที่ทำงาน

และสถานที่เก็บรักษาสารเคมีอันตราย

ของ บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

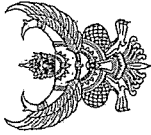
ใบอนุญาตเลขที่ ๐๒๐๒-๐๓-๒๕๖๔-๐๐๐๓

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|-----------------------------------|--|
| ๑. นายณัฐพงศ์ โคตะมา | |
| ๒. นายทวพงศ์ เขียววัฒนะ | |
| ๓. นางสาวอรรักษ์ สีแท้ | |
| ๔. นางสาวกนกวรรณ เริ่มประชาธิปไตย | |
| ๕. นายกิตติศักดิ์ เมืองงาม | |
| ๖. นางสาวนัฐธยาน์ สารแสง | |
| ๗. นายเจอ แ่งหว้า | |
| ๘. นางสาวกมลลักษณ์ ติมงคล | |

ทั้งนี้ ตั้งแต่วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔ ถึงวันที่ ๑๓ ธันวาคม พ.ศ. ๒๕๖๗

ให้ไว้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔

(นายสมพงษ์ กวางแก้ว)
ผู้ตรวจราชการกรม ปฏิบัติราชการแทน
อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน



แบบ กก.บญ
นิติบุคคล

กรมสวัสดิการและคุ้มครองแรงงาน

ใบอนุญาต

เป็นผู้ให้บริการตรวจวัดและวิเคราะห์สภาพการทำงานเกี่ยวกับระดับความร้อน

ใบอนุญาตเลขที่ ๐๔๐๑๐๓๒๕๖๔-๐๐๑๓

อนุญาตให้ บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

เลขทะเบียนนิติบุคคล ๐๑๒๕๕๗๗๐๙๙๗๑๑
ตั้งอยู่ เลขที่ ๑/๖ ซอยรวมแก้วแดง ๑๕๕ แขวงสะพานสูง เขตสะพานสูง กรุงเทพมหานคร
เป็นนิติบุคคลผู้ให้บริการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน ความปลอดภัย
กับहनคมวดรฐวนในภวนปรหวน จดัการ แลด้วนนภวนด้านความปลอดภย อาชีวอนามัย และสภาพแวดล้อม
ในภวนทำงานเกี่ยวกับความร้อน แสงสว่าง และเสียง พ.ศ. ๒๕๕๙ ในภวนตรวจวัดและวิเคราะห์
สภาพการทำงานเกี่ยวกับระดับความร้อน ประกอบกับกฎกระทรวงกำหนดเงื่อนไขและเงื่อนไขการ
เพื่อส่งเสริมความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๖๔ แห่งพระราชบัญญัติ
ความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๕๔ โดยมีบุคลากร จำนวน ๕ ราย

ทั้งนี้ ตั้งแต่วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔ ถึงวันที่ ๑๓ ธันวาคม พ.ศ. ๒๕๖๗

ให้ไว้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔

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อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน

รายชื่อบุคลากรแบบท้ายใบอนุญาต

เป็นนิติบุคคลผู้ให้บริการตรวจวัดและวิเคราะห์สภาพการทำงานเกี่ยวกับความร้อน

ของ บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

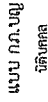
ใบอนุญาตเลขที่ ๐๔๐๑๐๓๒๕๖๔-๐๐๑๓

- | | |
|-------------------|----------------|
| ๑. นายปิยะชัย | บุญรุ่งเกียรติ |
| ๒. นางสาวกษิดา | จอกสูงเนิน |
| ๓. นางสาวสุวิศญา | อูนัน |
| ๔. นายภาคพล | มทวงศ์ |
| ๕. นางสาวอมรรักษ์ | โธมวาศย์ |

ทั้งนี้ ตั้งแต่วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔ ถึงวันที่ ๑๓ ธันวาคม พ.ศ. ๒๕๖๗

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(นายสมพงษ์ กวางแก้ว)
ผู้ตรวจราชการกรม ปฏิบัติราชการแทน
อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน



ใบอนุญาต

ใบอนุญาตนเลขที่ ๐๔๐๓-๐๓-๒๕๖๔-๐๐๐๓

เลขทะเบียนนิติบุคคล.....๐๑๒๕๕๓๗๐๐๘๕๗๑

เป็นต้นบทความนี้ได้รับการตีพิมพ์ครั้งแรกในวารสารศิลปวัฒนธรรม ฉบับกุมภาพันธ์ ๒๕๒๖

การดำเนินงานตามแผนปฏิบัติการประจำปี ๒๕๖๒

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นางสาวกัญญากร งามเมือง

เกียวกอบบักแก้ว, ประคบกับกัวการพรวงการชนะเบนและการอนุมัติให้บริการ เพื่อส่งเสริมความ

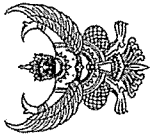
ปอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๖๔ แห่งพระราชบัญญัติความปลอดภัย

อาชีพอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๕๕ โดยมีบุคลากร จำนวน ๕ ราย

ให้ไว้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๕

(นายสมพงษ์ กว้างแก้ว)

วิธีปฎิการมลพิษคือการและคุ้มครองแรงงาน



แบบ กบ.บญ
ชนิดพิเศษ

กรมสวัสดิการและคุ้มครองแรงงาน
ใบอนุญาต
เป็นผู้ให้บริการตรวจวัดและวิเคราะห์ผลการการทำงานเกี่ยวกับระดับแสงสว่าง
ใบอนุญาตเลขที่ ๐๔๐๒๕-๐๓-๒๕๖๔-๐๐๐๓

อนุญาตให้.....บริษัท.เทคนิคสิ่งแวดล้อมไทย จำกัด
เลขทะเบียนนิติบุคคล.....๐๑๒๕๕๗๗๐๘๘๗๑๑
ตั้งอยู่.เลขที่.๑/๖.ซอยรามคำแหง ๑๔๕.แขวงสะพานสูง.เขตสะพานสูง.กรุงเทพมหานคร.
เป็นนิติบุคคลผู้ให้บริการด้านความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน ตามกฎหมาย
กำหนดมาตรฐานในกรณีตรวจวัด.จัดเก็บ.และดำเนินการด้านความปลอดภัย อาชีวอนามัย.และสภาพแวดล้อม
ในการทำงานเกี่ยวกับความสว่าง.และเสียง.พ.ศ. ๒๕๕๙.ไม่มีการตรวจวัดและวิเคราะห์ผลการ
ปฏิบัติงานระดับแสงสว่าง ประกอบกับกฎกระทรวงการขึ้นทะเบียนและการอนุญาตให้บริการเพื่อส่งเสริมความ
ปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๖๔ แห่งพระราชบัญญัติความปลอดภัย
อาชีวอนามัย และสภาพแวดล้อมในการทำงาน พ.ศ. ๒๕๕๔ โดยมีบุคลากร จำนวน ๕ ราย

ทั้งนี้ ตั้งแต่วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔ ถึงวันที่ ๑๓ ธันวาคม พ.ศ. ๒๕๖๗

ให้ไว้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔

(นายสมพงษ์ กวางแก้ว)

ผู้ตรวจราชการกรม ปฏิบัติราชการแทน
อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน

รายชื่อบุคลากรแนบท้ายใบอนุญาต
เป็นนิติบุคคลผู้ให้บริการตรวจวัดและวิเคราะห์ผลการการทำงานเกี่ยวกับแสงสว่าง
ของบริษัท.เทคนิคสิ่งแวดล้อมไทย จำกัด
ใบอนุญาตเลขที่ ๐๔๐๒๕-๐๓-๒๕๖๔-๐๐๐๓

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|-------------------|----------------|
| ๑. นายปิยะชัย | บุญรุ่งเกียรติ |
| ๒. นางสาวกษิดา | จอกสูงเนิน |
| ๓. นางสาวสุกัญญา | อู๋นิ่ม |
| ๔. นายภคพล | มทวงศ์ |
| ๕. นางสาวอมรรัตน์ | โสมมาตรย์ |

ทั้งนี้ ตั้งแต่วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔ ถึงวันที่ ๑๓ ธันวาคม พ.ศ. ๒๕๖๗

ให้ไว้ ณ วันที่ ๑๔ ธันวาคม พ.ศ. ๒๕๖๔

(นายสมพงษ์ กวางแก้ว)

ผู้ตรวจราชการกรม ปฏิบัติราชการแทน
อธิบดีกรมสวัสดิการและคุ้มครองแรงงาน